

THE
Daily Express
ENCYCLOPÆDIA

VOL. VII

OBER-AMMFRGAU TO SHANGHAI

THE
Daily Express
ENCYCLOPÆDIA

*INCLUDING 3500 ILLUSTRATIONS
WITH ATLAS & GAZETTEER INDEX*



Vol VII
OBE TO SHA

1934
DAILY EXPRESS PUBLICATIONS
LONDON

FIRST PUBLISHED IN 1934



ILLUSTRATIONS

The following are the full page photogravure plates in Vol. VII
additional to the illustrations in the text —

	<i>Facing page</i>
AERIAL VIEW OF THE POTTERIES	40
SCULPTURE THE WRESTLERS (UFFIZI GALLERY FLORENCE)	41
RAPHAEL CARTOON THE DRAUGHT OF FISHES (REPRODUCED BY GRACIOUS PERMISSION OF HIS MAJESTY THE KING)	56
RAPHAEL CARTOON (DETAIL) HEAD OF ST PETER FROM THE DRAUGHT OF FISHES (REPRODUCED BY GRACIOUS PERMISSION OF HIS MAJESTY THE KING)	57
SIMPLICITY BY SIR JOSHUA REYNOLDS	168
FRANKLIN D ROOSEVELT PRESIDENT OF THE U.S.A.	169
THE DAY DREAM BY DANTE GABRIEL ROSSETTI	184
LADY LOVAT AS A CHILD BY JOHN SINGER SARGENT	185
(1) SS PARMA (2) H.M. BATTLE CRUISER HOOD	296
R.M.S. AQUITANIA (CUNARD LINE)	297
SHAKESPEARE TITLE PAGE OF THE FIRST FOLIO	312
GEORGE BERNARD SHAW	313
SEVRES PORCELAIN LOUIS XVI CLOCK	424
SHOES OF VARIOUS COUNTRIES AND DATES	4-5
SHEFFIELD PLATE SUGAR BASIN (late 18th century)	440
SILVER (1) WILLIAM III TANKARD (2) CHARLES II PORRINGER (COVER AND TAZZA EMBOSSED AND CHASED)	441

PRONUNCIATION

THE imitated pronunciations are intended to assist the reader in the enunciation of unfamiliar words, and necessarily, especially in the case of foreign words, only afford a rough approximation to the actual sound. The signs used are to be pronounced as follows —

a	.	as a in hat	o	.	as o in not
ah	,	a in father	ō	,	„ o in note
ā	,	a in hate	u	,	„ u in but
ār	,	ar in hare	ū	,	„ u in tune
aw	.	„ o in more	ur	,	„ ur in lure
e	.	„ e in bell	oo	,	„ u in put
ē	..	„ e in bee	ōō	,	„ oo in boon
ēr	..	„ eer in deer	ou	,	„ ow in now
ē	..	{e in herd, or i in bird	ü	,	a in comma
i	.	„ i in bit	th	,	th in think
ī	..	„ i in bite	dh	,	th in there
īr	.	„ i in fire	gh	,	ch in loch
			zh	,	s in pleasure

Other consonants are given their ordinary English sound.

Obliquity of the Ecliptic

Oberammergau, Bavarian village SSW of Munich a few m N of the Austrian border. Toys and pottery with crucifixes and various other articles of pety are made but the great interest of the place is the Passion Play produced once every 10 years since 1634 and is in its way one of the most remarkable dramatic performances in Europe attracting many thousands of visitors. It represents the final events of the life of Christ

the *Onates of Mary Immaculate* established at Marseilles in 1815

Obligation Days of feast-days kept by the Roman Catholic Church in a similar way to Sundays on which Catholics have to hear Mass and abstain from servile work. In England they are the Circumcision (Jan 1) the Epiphany (Jan 6) Ascension Day Corpus Christi, St Peter and Paul (Jan 29) the Assumption (Aug 15) All Saints Day (Nov 1) and Christmas Day



Passion Play Scene

Oberammergau

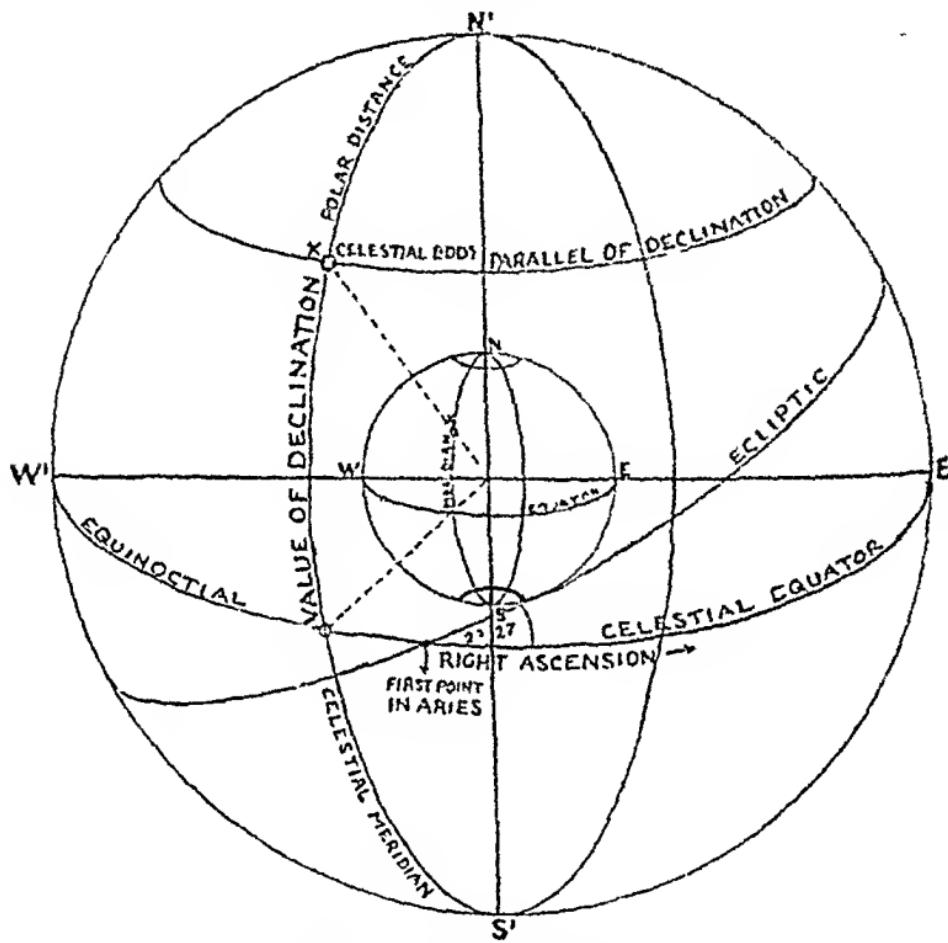
and is acted in the open air with the greatest possible reverence. The players are villagers trained for months or even years. The performance lasts about 8 hours and has in all several hundred characters. See also MYSTERIES PASSION PLAY

Oblates members of the Roman Catholic Church who dedicate themselves to the service of religion as laymen as the *Oblates of St Charles* founded in 1578 the *Oblates of St Francis of Rome* founded 1433 the *Oblates of Italy* founded 1816 and

In Scotland St Joseph (Mar 19) and the Immaculate Conception (Dec 8) and in Ireland the Immaculate Conception and St Patrick (Mar 17) are added.

Obliquity of the Ecliptic. The ecliptic is the circle round the celestial sphere formed by the apparent motion of the sun. The celestial equator is a similar circle formed by a continuation of the plane of the terrestrial equator. The ecliptic and the celestial equator are inclined to each other at an angle of c. $23\frac{1}{2}$. This inclination is

called the Oblliquity of the Ecliptic; telling the movements of these, and and it is the cause of the cycle of the for classifying and tabulating such earth's seasons (*q.v.*). observations in such a manner as to



THE CELESTIAL SPHERE

Oblivion, or Indemnity, Act of, see INDEMNITY, ACT OF

Oboe, see ORCHESTRA

O'Brien, Kate (*b.* 1899), Irish dramatist and novelist. She first came into prominence with the play *Distinguished Villa* (1920). Her novel *Without My Cloak* (1931) won the Hawthornden Prize.

Observatories, Astronomical, institutions for the scientific study of the celestial bodies, for recording and fore-

make these, and deductions from them, available for various practical purposes. Of the uses to which the results of astronomical observations have been put, the most generally understood and appreciated are the computation of time (see CALENDAR), and the placing of navigation on a scientific basis (see NAUTICAL ASTRONOMY).

Astronomical observatories existed in very ancient times in China and Babylon, and from these the heavens

Observatories

were studied to a remarkable degree of accuracy but apart from these their history begins with the establishment of an observatory at Alexandria in the 3rd cent. B.C. Hera Hipparchus of Rhodes discovered the precession of the equinoxes and later Ptolemy compiled a catalogue of stars. Observation of the heavens was continued during the Dark Ages and the Middle Ages chiefly by the Arabs but their studies did not materially advance the science of astronomy beyond the discoveries of Hipparchus and Ptolemy. The observatory of Tycho Brahe (q.v.) at Hveen founded in 1576 occupies an important place in the history of these institutions. It may be regarded as the pioneer of modern observatories since the astronomical instruments installed by Tycho were much superior in size and efficiency to previous instruments of the same nature. From another point of view Tycho's observatory marks the end of an era in astronomical science for it was the last important observatory founded before the invention of the telescope.

The telescope (q.v.) was invented in 1609 and this development quickly led to the foundation of a new class of observatories mostly in connection with various universities. The Paris Observatory was founded in 1667 and the Greenwich Observatory in 1675. Other important observatories are the following: British Isles, the Radcliffe Observatory Oxford, the Cambridge University Observatory, the Royal Observatories at Edinburgh and at Dunsink Dublin; France, Marcellies, Nice, Germany, Berlin, Kiel, Göttingen, Leipzig, Italy, Rome, Naples, Milan, Denmark, Copenhagen, Holland, Leyden, Helsingør, Trondhjem, Tønsberg, Trondheim, U.S.A., the Yerkes Observatory Williams Bay, the Lick Observatory California, the Harvard University Observatory, South Africa, the Royal Observatory at Cape Town, Australia, Sydney, Perth, Melbourne.

Construction and Instruments. The

Observatories

ideal situation for an observatory is on high ground where a clear view of the sky can most frequently be expected. The main structural feature of an observatory is the dome containing the telescope. A portion of this dome can be opened so that the telescope may be directed at any angle from the vertical to the horizontal and the whole dome can be made to rotate so as to bring any point in the sky within the range of the telescope. Further the speed of the dome's rotation is correlated with that of the earth's movement and the movement of the body under observation so that an uninterrupted view of this last can be automatically obtained. A telescope mounted so as to rotate in this way is known as an *Equatorial*. The *Transit Instrument or Meridian Circle* is a telescope which is kept constant in the observatory's meridian and is used in conjunction with a *Sidereal Clock* for measuring the exact time at which a body enters its field of view. The above are the most important astronomical instruments though a large observatory houses many others for various measurements and observations.

Time. It has already been said that the computation of time is one of the main purposes of astronomical observation. The period of the earth's rotation upon its axis i.e. a day can only be measured by reference to some heavenly body and reference to different kinds of bodies gives rise to different standard rotation periods. If we take a fixed star for reference the earth's rotatory period does not vary with its position in its orbit round the sun and this gives us *Sidereal Time*. For general purposes however it is more convenient to take the sun as the point of reference giving us *Solar Time* but since the earth moves forward along its orbit while it is rotating it must make rather more than a complete rotation in order that a given point on its surface may face the sun after the lapse of a day. Further the earth's speed in its orbit is

subject to variation, so that a solar day is not constant throughout the year, and it is therefore necessary to fix an average length for the solar day, upon which is based the reckoning of, for example, *Greenwich Mean Time*. Midday is the moment of time at which the sun crosses the meridian of a given locality, therefore it occurs at different times on different meridians, and only places on the same line of longitude have the same *Local Time*. It is usual for a self-contained region to adopt the local time of the most important town within it as a standard, called *Zone Time*. In Europe there are three standard times—*Greenwich mean time*, *Central European time*, and *Eastern European time*. See also *ASTRONOMY*.

Obsidian, acid volcanic igneous rock with a glassy texture due to rapid cooling, so that the crystals have no time to form. In time, the tendency to crystallise may manifest itself, and the glassy rock may become converted into a stony mass. Obsidians are usually red, green, or black, and are often vesicular in structure, owing to steam bubbles in the magma, which in an extreme case produce pumice (*q.v.*)

Ocarina, a small wind instrument consisting of a pipe pierced with holes for the fingers. When played, it produces a whistling sound less shrill than that of an actual whistle. Usually made of terra-cotta but sometimes of metal.

Occleve (or *Hoccleve*), Thomas (c. 1370–1450?), English poet, of whose life little is known. Of his works, *The Regement of Princes*, a homily addressed to Henry V, several moral tales in verse, and the *Dialog with a Friend*, are the best known. They are of little value and fall far below those of Chaucer, whom he took as his model.

Occultation, see *Moon*.

Oceania, general term for the great Pacific territories, extending from Australia to the most E of the Pacific islands, and from New Zealand to Micronesia. It is divided into a number of well-marked ethnological and

geographical areas, notably Australia, Tasmania, Melanesia (the islands from Fiji to New Guinea), New Guinea, Polynesia (the islands E and N. of Fiji), and Micronesia, the groups N. of New Guinea, and including the Philippines. For details see *AUSTRALIA*; *NEW ZEALAND*, *PACIFIC ISLANDS*, etc.

Oceans and Seas, the main divisions of the water which covers about three-quarters of the surface of the earth. Oceans are the large widely inter-communicating expanses, seas are smaller, communicating with the oceans by comparatively narrow channels. It is customary to admit five oceans: (1) the S. or Antarctic Ocean; (2) the Pacific Ocean, (3) the Indian Ocean, (4) the Atlantic Ocean, and (5) the Arctic Ocean (*qq.v.*), although the last is sometimes regarded as a sea.

The total amount of water on the earth has been estimated at c. 335 million cubic m., most of which is in the salt oceans and seas.

In the open sea the average surface temperature varies less than 1° F between day and night, and between 5° and 10° F yearly. In the tropics it is above 80° F throughout the year, and in the Red Sea has been known to rise to nearly 100° F. Whatever the surface temperature, at a depth of 400 fathoms there is a practically universal temperature of 40° F or slightly less, and from this it declines slowly to the ocean bed.

The evaporation of the Red Sea greatly increases the concentration of salt near the surface, and the denser water thus formed sinks to the bottom and is replaced by fresher water from the Indian Ocean, but, as the salinity of the Red Sea remains constant, the salt water must pass out into the Indian Ocean by an undercurrent. In the Black Sea, on the contrary, the great rivers supplying it furnish more fresh water than the evaporation removes, but, again, the unchanged salinity indicates an undercurrent, this time bringing salt water to the sea. Wind pushes down the area of

water against which it strikes thereby ridging up the adjoining portions as a wave the shape of which advances before the wind though the particles of water merely move up and down from trough to crest as may be seen from the behaviour of floating objects. If a wave enters the shallowing water adjoining land the upper part over laps the lower which is retarded by friction against the bottom and finally curves over the wave breaking. The maximum speed at which a wave can travel is c. 80 m an hour and the highest waves due to wind are c.

water from the W coast of Africa across the Atlantic into the Gulf of Mexico the level of which is raised to 3 ft above that of the Atlantic. Hence a current of warm water the Gulf Stream issues through the Strait of Florida at a speed of 5 m an hour it is 60 m wide and 350 fathoms deep. It sweeps along the American coast growing wider and shallower and at about lat 40° N turns E diminishing its velocity and passes along the W coast of Europe. It is responsible for the mild climate of Great Britain and for the warmth and moisture of the



CHIEF OCEAN CURRENTS

50 ft. from crest to trough. Earthquake waves may however be much larger. Wind is also responsible for surface drift and by driving warm or cold water may set up currents due to change of temperature such as the cold current off the W coast of S America and the warm Gulf Stream from the Caribbean Sea. The currents of the Indian Ocean change twice yearly with the monsoons but in general ocean currents are unconnected with surface drift and behave as if they were rivers flowing through the ocean.

In the N. Atlantic there are two currents of primary importance. The trade winds drive warm surface

SW wind. The other important current is the cold Labrador current which driven by N winds from the Arctic past the coast of Labrador and meeting the warm Gulf Stream off Newfoundland produces the frequent fogs of that coast. It also bears the icebergs so dangerous to shipping.

*See G. H. Fowler *Science of the Sea* (1912) Sir John Murray and J. Hjort *The Depths of the Ocean* (1912). See also reports of the Challenger expedition.*

Ocelot, the largest of the tiger-cats (*Leopardus*) found in tropical America considerably larger and more powerfully built than the domestic cat and hand

somely marked with chains of spots forming longitudinal stripes, on a ground-colour varying from grey to yellowish red, the former variety being called the grey ocelot and the latter the painted ocelot

Ochil Hills, group of hills in Scotland extending from the R Teith to the Firth of Tay, culminating in Ben Cleith (2100 ft.)

Ochre, generic name for a series of naturally occurring mineral pigments which consists of various types of clays coloured with hydrated ferrie oxide. The natural colour of ochres is yellow, brown, or red, but a large number of intervening shades can be obtained by roasting and other treatments.

Ockham, or Occam, William of (d. c. 1349), English Franciscan monk and schoolman, known as the Invincible Doctor, was born at Ockham in Surrey. He was a great exponent of the doctrine of nominalism as opposed to realism, and in his political writings supported the secular power against the Papacy. He died at Munich.

O'Connell, Daniel (1775-1847), Irish patriot, known as "the Liberator," born in Kerry. At 23 he was called to the Irish Bar, where he became a brilliant advocate. He was greatly attached to the cause of Irish freedom and Catholic rights, and combined the two ideas by organising all Irish Catholics in an anti-English Association through the local priests. He was Member of Parliament for Clare in 1828. Emancipation was granted in the following year. He advocated reform, and mobilised his followers in opposition to tithes, supporting the Whigs. In 1841 he attacked the Union and the Conservative administration of Peel. To add force to his demands he reorganised the Catholic Association, and was imprisoned for sedition in 1844. On his release his health was broken and his power gone. A young revolutionary party was growing up that ignored him. Three years later he died at Genoa on his way to Rome. All his four sons sat in Parliament.

O'Connor, Thomas Power (1818-1929), Irish politician and journalist. At the age of 21 he came to London and joined the *Daily Telegraph*, coming into prominence with the publication of his book on Disraeli in 1879. He became an ardent Irish nationalist, and represented Galway in Parliament from 1880 to 1885 (afterwards being the Member for the Scotland Division of Liverpool). He continued his journalistic activities, and founded *The Star* in 1887. *The Sun*, his next venture, was unsuccessful, but *T.P.'s Weekly* found its niche as an inexpensive literary and popular journal. Generally known as T.P., or Tay Pay, he became very popular. He was President of the Board of Film Censors in 1917, and soon after became the "father" (or senior member) of the House of Commons, receiving in 1923 a presentation from all parties. In 1924 he was made a Privy Counsellor. He spent the last years of his life in writing *Memories of an Old Parliamentarian*.

Octopus, a mollusc (*q.v.*) of the class Cephalopoda differing from the cuttle-fish and squids by having eight arms and no shell or fins. They can swim backwards with considerable speed, but spend most of their time at the bottom of the sea, crawling slowly about the rocks. They feed mostly on crabs or lobsters, and some reach a large size with an arm-span of 10 or more feet.

Oetroi, a station at the entrance of a town or department for the collection of local dues and tariffs within a country. The system is an ancient one in France, was abolished for a time at the Revolution but soon re-established, and is still in force. Articles of local consumption are taxable, with the exception of necessities. A similar system prevails in Italy and Spain.

Oddfellows, see FRIENDLY AND BENEFIT SOCIETIES

Ode, a poem, not of great length, frequently of irregular or complicated lyrical form, usually written for some special occasion. The term was originally applied to the choric songs of the

Greek drama and also to the poems of Pindar Sappho Horace etc A sustained note of exalted enthusiasm should be the dominant characteristic of an ode.

Oder river rising in the Odergebirge in Northern Czechoslovakia and flowing first N W through part of Poland into Germany and then to the Baltic Sea which it joins by three arms at the Kleines Haff just N of Stettin The Oder is navigable for small craft from Ratisbon and for large vessels from Breslau It is linked to the Vistula Spree and Havel by canals Under the provisions of the Treaty of Versailles the Oder was declared open to the traffic of all States through whose territory it flows Length 550 m

Odessa, port on the Black Sea between the mouths of the Dnieper and Dniester It has extensive docks and harbours and there is a vigorous trade in the varied products of the district including cereals live stock timber wool and sugar There is a special harbour for the shipment of petroleum Local industries are salt machinery glass and preserved food stuffs It is the chief port of the Ukraine Pop (19 6) 475 400

Odin, in Norse mythology the great god of the gods called also Woden and Wotan the protector of most arts and sciences and the wielder of the thunder bolt He is represented with one eye only the other one having been taken by Mimir as payment for a drink from his well Wednesday is named after Woden

Odysseus in Greek legend the hero of Homer's *Odyssey* called by the Romans Ulysses (q v)

Ecumenical, belonging to the whole inhabited world applied generally to the whole Christian Church and specifically to the General Councils (see COUNCIL) of the Primitive Church In the interpretation of the Roman Catholic Church an Ecumenical Council must be presided over by the Pope or his representative

Œdipus [E DIPUS] in classical legend

a king of Thebes son of Jocasta It had been prophesied that he would kill his father who therefore ordered that he be destroyed at birth Jocasta his mother exposed him on Mount Citheron but he was found and educated by the King of Corinth When he was of age he travelled and meeting his father on the road ignorant of his identity quarrelled with and killed him Reaching Thebes he saved the country from the ravages of the Sphinx by answering the riddle it propounded For this he was made king and still ignorant of his own identity he married Jocasta Ultimately the oracle made clear the terrible mistake and in his grief Œdipus fled When he came to the place where he knew he was to die the earth opened and swallowed him up The legend is immortalised in Sophocles's two tragedies *Œdipus Tyrannus* and *Œdipus Coloneus*

Cœnone [KNOE NE] in classical legend a river nymph who was gifted with powers of healing and married Paris before his identity was known When Paris who had deserted her for Helen of Troy was wounded in the Trojan War she refused her aid and he died before her eyes She was so grieved stricken that she committed suicide

Cœnothera (or Evening Primrose) hardy annuals or biennials with large entire ovate leaves and erect stems bearing racemes of large yellow white or rose fragrant flowers which open only in the evening

Oesel, see SAARE MAA

Offa (d A D 796) King of Mercia (from 757) seems to have exercised authority over the kingdoms of Kent, Sussex and Wessex as well as over Mercia Evidence of this is found in his appropriation to the see of Lichfield of much of the power of the Archbishop of Canterbury He is thought to have been the builder of Offa's Dyke (q v)

Offaly (formerly King's County) Irish Free State county between W Meath on the N and Leix on the S Except for part of the Slieve B

Mountains in the S and Croghan Hill in the N E, the surface is flat, and consists in the centre of the extensive Bog of Allen. The chief rivers are the Shannon, which marks a part of the Western border, and the Brosna. Agriculture is the staple occupation. Oats, barley, rye, potatoes, and other vegetables are grown and there are large pasturage areas, where cattle, sheep, and pigs are bred in considerable numbers. There are no industries of importance. Communications are good, and the Grand Canal is of value in this respect. The principal towns are Tullamore, the county town, Philipstown, and Birr. In various parts of the county are a number of interesting ruins, including the Seven Churches of Clonmac Nois. Area 771 sq m., pop. (1928) 52,600.

Offa's Dyke, earthwork on or near the English-Welsh border, supposed to have been constructed c. 770 by Offa, King of Mercia (757-796), from the Wye to the Dee to protect his frontiers in times of war and to serve as a boundary in times of peace.

Offenbach, Jacques (1810-1880), French composer of light operas, born at Cologne, studied at the Paris Conservatoire. Conducted at the Théâtre français, and produced *Pepito* unsuccessfully in 1853, but had a series of successes with such works as *Orphée aux Enfers* (1858), *La Belle Hélène* (1864), *Barbe-Bleue* (1866), *La Vie Parisienne* (1866), *La Grande Duchesse* (1867), *Madame Favart* (1879), and the posthumous *Les Contes d'Hoffmann* (*Tales of Hoffmann*), which has become the most popular of all his works.

Offertory, alms collected from a congregation at a religious service. In the Roman Catholic Church the offertory is a chant sung while the priest prepares the elements, in the Church of England, the sentences read at Communion during the collection of alms.

Officer, Holy, a Congregation of Cardinals (*q.v.*) of the Roman Catholic Church whose duty it is to protect the purity of the faith and take

measures against heretical opinion. They are also in charge of the Index of Prohibited Books. See INDEX LIBRARUM PROHIBITORUM.

Officer, one who holds any official or administrative position, and especially one who holds the King's Commission in the Army or Navy, the word having acquired the latter significance in the late 16th cent. Military officers on full pay may not become company directors or municipal officials. They may not leave the country without special permission. See also RANK.

Officers' Training Corps, an organization formed in March 1908 for the provision of military training in schools and universities. The senior division of the O.T.C. is drawn from the universities, the junior from public schools. Military drill, musketry and signalling courses, camps, and other activities are undertaken. Members of the O.T.C. take examinations qualifying them for a proficiency certificate. This certificate allows exemption from part of the examination for officers in the Territorial Army and Reserve force, to which many members progress. The O.T.C. supplied 35,000 officers in the World War. The King is Colonel-in-Chief. See also CADET.

Official Secrets Acts (1911 and 1920). By these Acts it is made an offence to communicate any military or naval information, documents, models, plans, etc., to anyone to whom it would not be in the public interest to make such communication, or to spy in a "prohibited place," arsenal, dockyard, office, etc., belonging to the King.

Offset Measurement, see SURVEYING.

Offset Printing, see LITHOGRAPHY.

O'Flaherty, Liam, Irish novelist, is the author of *The Neighbour's Wife*, *The Informer*, *The Assassin* (1928), *Two Years* (1930), *The Pupil*, *Skerrett* (1932), and other novels and volumes of short stories. He has specially made his own the short story of animal life in nature without human characters. His stories of Irish life are sometimes exaggerated, but always powerful, they show the influence of

Dostoevsky though lacking his gift for characterisation

Ogilby John (1600-1666) Scots author was satirised by Dryden and Pope. He was chiefly known for his translations of Vergil Homer and Aesop. He settled in London and after the Great Fire (1666) set up a printing press and published many fine volumes.

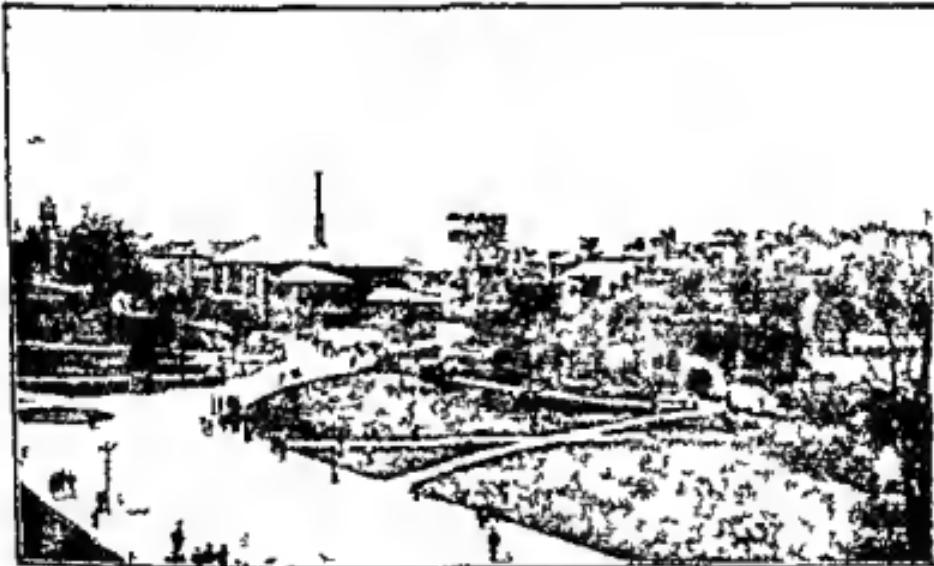
O Grady Standish James (1840-1913) Irish historian his antiquarian studies had a great influence on the Celtic revival. They include a *History of Ireland The Heroic Period* (1878) and *Cuculain and his Contemporaries* (1880) and many historical romances dealing with the same early period. Among his novels are *Ulrich the Ready* (1896) and *Red Hugh's Captivity* (1889).

O Higgins Kevin Christopher (1880-1977) Irish politician born at Stradbally educated at Clongowes St Patrick's College Carlow and the National University of Ireland. He was articled to a solicitor and joined the Sinn Fein movement in 1916 after the Easter Rebellion. Elected member for Queen's County in 1918 while he was still in prison in 1920 he became

a minister in the provisional government. He established the Civic Guard in his capacity of Minister of Justice in the Irish Free State Government was called to the Irish Bar in 1923 and in 1927 became Minister for External Affairs. In June of the same year he was shot dead at Booterstown as a result of the hatred he aroused by his stern measures when Minister of Justice.

Ohio (1) American State bounded N by Lake Erie S by Kentucky E by Pennsylvania and W Virginia and W by Indiana. The surface consists of an extensive plain crossed from SW to NE by an irregular range of low hills forming a watershed between the drainage towards the lake and that towards the Ohio R which with its tributaries waters much of the surface. There are rich deposits of coal and iron and iron and steel industries for which Ohio ranks second in the USA.

Agriculture is widely distributed and large crops of cereals and fruit are grown the latter supplying the canning industry. More than a million cattle and a half cattle and a million pigs are



Old St. Uiversity

raised there, providing material for the dairy and meat-packing industries. The output of Ohio is aided by the transport facilities offered by lake and rivers, as well as the highly developed road and rail systems. Many inventors have sprung from Ohio, and there is a saying "Some men are born rich, some men are born lucky, and some men are born in Ohio." Area, 41,000 sq m, pop (1930) 6,646,700.

(2) American river, one of the chief tributaries of the Mississippi. After receiving the Allegheny and Monongahela Rs at Pittsburgh the stream flows SW along the borders of Ohio and Indiana, and joins the Mississippi at Cairo. With its numerous tributaries it waters some 200,000 sq m, and is navigable from Pittsburgh. Length, c 960 m.

Ohmmeter, see ELECTRICAL MEASURING INSTRUMENTS

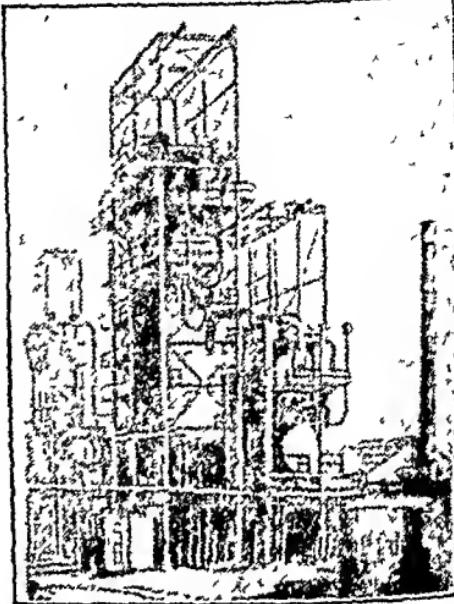
Ohm's Law, see ELECTRICITY

Ohnet, Georges (1848-1918), French novelist, was born in Paris, and after the Franco-Prussian War edited successively *Le Pays* and *Le Constitutionnel*. In collaboration with Denayrouze he wrote a play, *Regina Sarpi*, 1875. His first novel, *Serge Panne*, appeared in 1881, and in the following year he wrote *Le Maître de Forges*, which was successfully dramatised in France and England, where it was played for years as *The Ironmaster*. He wrote many other romances characterised by melodrama and passion.

Oil. With the invention of the internal-combustion engine by Daimler in 1886, oil rose from the status of a product used for primitive heating, lighting, and lubrication to one of primary economic importance.

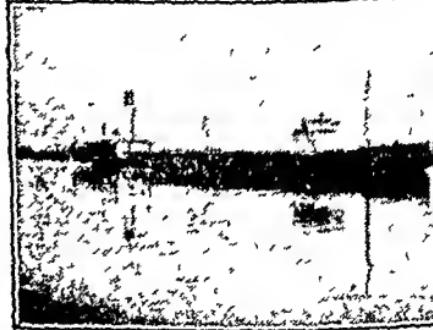
Crude oil as brought from the well is separated into petrol (gasolene), paraffin, and fuel oil. In early motoring days the only demand was for petrol, and the other products were wasted. After 1914 fuel oil was burned under boilers like coal, and was considerably used for shipping.

The first process in finding oilfield is prospecting, which is done principally by surface examination and the discovery of subterranean rock-forma-



Towers in a modern Oil Refinery From etching in the collection of the Guardian Trust Co., Cleveland, Ohio

tions with the seismograph. Drilling is then begun, and, where an oil bed has been tapped, the pressure usually forces oil to the surface in the first instance, and if the pressure is



Oil Derrick

volume of oil are very great a gush is formed.

The production of a field rises in very short time to its maximum, which may be as much as 100,000 barrels

day. Its output then drops at first rapidly and afterwards more slowly. The transport both of crude and refined oils is highly organised. On land oil is conveyed by a system of pipe-lines (q.v.) which is composed of gathering and trunk lines much like a railway system and is controlled by pumping stations.

The distribution of oil production varies greatly from year to year as different areas rise and decline in importance. From the time of the earliest intensive drilling however the United States has constantly supplied about 70 per cent of the world's production.

One of the chief features of post War oil production has been the rapid rise of Venezuela which increased its output from half a million barrels in 1918 to 1.7 millions in 1930.

I was under the Five Year Plan exploited her Transcaucasian oilfields intensively and raised production from 90 million barrels in 1918 to 159 millions in 1931 thus taking second place to America. Persia and Burma under British control have been

severely restricted in output in contrast to American exploitation. The oilfields of the remaining important producers Romania are also largely exploited by British capital. Small outputs are registered by other South American and European countries. World production for 1914-1931 and 1932 was as follows:

	1 Mln. m B. bl		
	1914	1929	1932
U.S.A.	714	10	7
Russia	45	1.4	142
Venezuela	8	137	118
Turkey	11	25	55
U.S.S.R.	21	49	45
India	12	44	52
Burma & India	21	38	29
Other	47	9	75
World	1316	1470	1790

No. - 10 barrel eq. v. 11.33 Imperial gallons.

The problem of over production due to competitive methods has recently been attacked by international agreements to which all important exporting producers now subscribe.



General view of Oilfield, Georgia, Russia

Oil-beetle, a large blackish ground-beetle related to the Blister beetle and taking its name from the oil it exudes from its joints when handled. The larvae, hatched on the ground, climb plants and attach themselves to bees which carry them to the hive, where they feed on the honey and complete their growth.

Oilcake, see AGRICULTURE, CATTLE

Oil Gas, obtained by the vaporisation of mineral or other oils. It is also known by the name of the system by which it is produced, e.g. Blau gas, Pintsch gas (*qq v.*)

Oils, Essential, see ESSENTIAL OILS

Oils, Fats, and Waxes The expression "oil" as used here includes only the fatty oils, which are distinct from other substances to which the term "oil" is applied such, for instance, as the mineral oils (*see under PETROLEUM*) and the volatile oils from plants (*see ESSENTIAL OILS*).

Fatty oils are composed of glycerides, together with small quantities of other materials, such as sterols and pigments.

In plants the fats are concentrated almost entirely in the seeds or fruits, but animal fats are distributed over the entire body, being most prevalent in the abdominal wall.

In addition to the distinction by their origin as animal or vegetable, oils may also be divided into drying and non-drying. The drying oils are those which when exposed to the air form a plastic film. This property is of great value, inasmuch as it permits these oils to be used in the manufacture of paints and varnishes. The drying oils are almost entirely of vegetable origin.

A special class of animal oils of great scientific and economic interest includes those obtained from marine animals. These oils may be divided into three classes: (a) those obtained from the bodies of fish, such as menhaden oil, (b) those obtained from the liver of fish, e.g. cod-liver oil, and (c) those obtained from the blubbers of marine mammals, such as whale oil.

An interesting group of vegetable oils deserving special mention includes

those obtained from the seeds of plants of the botanical family Flacourtiaceæ. The principal members of this group that are of commercial value are chaulmoogra oil and *hydnocarpus* oil, which possess strong curative action in leprosy.

The use to which an oil or fat is to be put determines the type of refining treatment that it receives. In nearly all cases, except when the raw material is absolutely fresh and in first-class condition, the oil contains traces of free fatty acids liberated by the decomposition of the glycerides of which the oil is composed.

The use of fatty oils for lubricating purposes, whilst at one time widespread, is now very much less so, owing to the greatly superior products obtainable from petroleum. The only fatty oil that is of importance from this point of view is castor oil, which is still used to a very large extent for the lubrication of the better class of petrol motor, such as that used in aircraft and high-grade motor vehicles.

The adulteration of oils and fats used at one time to be very prevalent, but now, owing to the great development of this branch of analytical chemistry the practice has considerably decreased. The analysis of oils and fats is carried out very largely by determining certain constants, both physical and chemical, for a large number of oils, so that by comparing the constants of a sample with those known for a genuine oil it can be seen whether there is a reasonable degree of agreement or not.

The unsaponifiable, or non-fatty portion, of oils and fats seldom exceeds about 15 per cent. It is often, however, an extremely important portion, since it contains in many cases the fat-soluble vitamins which are so necessary to human health. The fat-soluble vitamins which have so far been identified are A, which is anti-xerophthalmic, anti-infective, and growth-promoting, D, the anti-rachitic vitamin, and E, the fertility factor. The last-named, which is found in the oils obtained from the germs of cereals,

as not as yet been proved to have any physiological action on man and so it will not further be considered.

The oils that are richest in vitamins A and D are the liver oils of fishes and it is this that makes these oils of great medicinal value. The best known and most widely used is cod liver oil which is highly active in both vitamins

Halibut liver oil which has lately come into prominence is the richest known source of vitamin A and in fact most fish liver oils contain one or both of these essential substances.

Waxes. These are substances which whilst similar to the fats in appearance and physical properties are chemically distinct. The fats are a combination

TABLE OF THE CHIEF OILS AND FATS
A. VEGETABLE OILS AND FATS

Name	Principal Source	Chief Country of Origin	Iodine Value	Saponification Value	Principal Uses
(i) Dry oils					
Linseed oil	Linum usitatissimum	U.S.S.R. U.S.A. Argentina China	130-190	190	Fa ^t varnishes Paints
Tung (China wood) oil	Aceites fordi	China	150-163	190	Fa ^t varnishes
Sunflower seed oil	Melampsora annua	U.S.S.R.	125-130	190	Food
Soybean oil	Glycine soja	Manchuria China	120-133	190	Food Paints
(ii) Semidry and half-dry oils					
Sesame oil	Sesamum indicum	India F.E. East	101-110	190	Food
Cottonseed oil	Gossypium hirsutum	U.S.A. India Egypt	100-110	190	Food
Castor oil	Castor officinalis	India	105	10	Medicinal
Rape oil	B. sativa compacta	India Europe	95-105	170-180	Food. H. taling
Almond oil	Prunus amygdalus	South & E. Europe	90-100	190	Pharmacy
Hydrocarpus oil	Hydrocarpus	Burma Thailand	90-100	90	Medicinal
Arachis (peanut)	Araucaria hypoleuca	W. Africa Spain U.S.A.	90-95	190	Food soap
Castor oil	Ricinus communis	I. d. U.S.A.	80-90	175-185	L. br. a. t. Medicinal
Olive oil	Olea europaea	Italy Spain N. Africa	75-85	190	Food. Soap
Palm oil	Fit. guineensis	W. Afr. E. Indies	40-50	200	Food. Soap
Cacao butter	Theobroma cacao	W. Afr. T. uinidad C. yl.	55	190	Food. Pharmacy
Cocnut oil	Cocos nucifera	Pacific	8-10	250-300	Food. Soap
Japan wax	Rhus vernicifera	I. d. Japa	10	270-285	Polish

The term wax here is a popular misnomer. It is a substance chemically fat. Similarly sperm oil, whilst called an oil, is actually a wax (see below).

B. ANIMAL OILS AND FATS

Name	Iodine Value	Saponification Value	Principal Uses
Shark-liver oil	60-300	85-190	Leather dressing
Menhaden oil	160-180	190-235	Paints. Paints
Cod-liver oil	160-170	160-190	Medicinal
Silk-worm oil	130-131	190	Soap
Whale oil	110-120	180	Soap. Laundry
Herring oil	60-70	190	—
Lard	40-60	190	Food
Beef tallow	40	200	Food
Cow's butter fat	10	220-230	Food

It should be noted that the figures given in the above table for the saponification and iodine values are approximate and are not added. I. d. values can only be used as analytical guides. For this purpose the standard works on the subject must be consulted.

of glycerine (a trihydric alcohol) with three molecules of fatty acid, whereas the waxes consist of a compound of a monohydric (in a very few waxes a dihydric) alcohol with a fatty acid.

As in the case of the fats, waxes are obtained both from animal and vegetable sources, and there are also mineral waxes, such as montan wax, which are in reality the remains of fossilised vegetable products. Paraffin wax is chemically not a wax at all, since it is a mixture of hydrocarbons.

The principal solid animal waxes are beeswax, which is used for polishes and candles, and wool "fat," from which lanolin for ointments is manufactured. The only vegetable waxes of commercial importance are carnauba wax and sugar-cane wax. They are employed in the manufacture of candles, polishes, and gramophone records. The vegetable waxes occur as exudations on leaves and fruits.

CONSULT *Chemical Technology and Analysis of Oils, Fats and Waxes*, by J. Lewkowitsch (6th ed., London, 1922), *The Industrial Chemistry of the Fats and Waxes*, by T. P. Hilditch (London, 1927).

Oils, Mineral, see PETROLIUM

Oils, Volatile, see ESSENTIAL OILS

Oise [WAHZ], French department immediately S of Somme, lying largely within the basin of the Oise R. The surface is flat, and fairly well irrigated with a sufficient rainfall for agriculture, which forms the main occupation of the people and produces crops of cereals, sugar-beet, and vegetables. There are extensive pastures, and a large dairy industry, while a number of rich forests provide timber for furniture and similar industries. Except for clay and building stone, mineral deposits are few, but there are several thriving industries, of which the most notable are textiles, iron and steel, chemicals, and woollens. Sugar and cider making arise from the natural products. Beauvais is the capital, and Creil, Senlis, Clermont, and Compiègne are the largest towns. Mineral springs occur at Chantilly, Pierrefonds, and

elsewhere. Area, 2,270 sq. m., pop. (1931) 407,400.

Okapi, the only living representative of the Giraffe family, except the giraffe itself, from which it differs by its smaller size, comparatively short neck and legs, and its colouring, the body being blackish chestnut, the head mostly greyish fawn, and the legs and thighs vividly striped with black and white. Also there is little difference in size between the sexes, the height at the shoulder being about 5 ft., but the female is hornless, whereas the short horns of the male have the tip bony and uncovered by skin. The okapi



Okapi

lives in couples in the Congo forest and feeds on foliage.

Okhotsk, Sea of, small portion of the N Pacific off the E coast of Siberia. It is joined to the Sea of Japan by the Gulf of Tartary, and extends E as far as the Kuril Islands.

Oklahoma, American State bounded N by Kansas, S by Texas which also forms its W boundary, and the Red R., and E by Arkansas and Missouri. The conditions of soil, climate, and water supply, mainly from the Arkansas and Red Rs with their tributaries, are well suited to agriculture, and very large crops of cereals, cotton, and fruit are raised. There is extensive pastureland, with more than a million cattle, and many pigs. Since the comparatively recent discoveries of its petroleum supplies, the centre of Oklahoma's wealth has shifted from agriculture to minerals, and it is now in the front rank as an

oil producing State with an average annual production of c. 200 million barrels

Coal zinc and lead are all worked These rich resources to which the quantity of good timber available must be added have helped to bring the State well to the fore industrially Flour milling metal founding cotton goods and dairy produce all provide large revenues The chief towns are Oklahoma city the capital Tulsa and Muskogee Area 70 000 sq m pop (1931) 2 400 000

Old Age Pensions, see PENSIONS
Widows ORPHANS AND OLD AGE
Old Bailey see CENTRAL CRIMINAL COURT

Oldcastle Sir John (d. 1417) English leader of the Lollards (the followers of John Wycliffe) and the supposed original of Falstaff in Shakespeare's *Henry IV* became friendly with Prince Hal in the Welsh wars and served in France in 1411 He was sentenced in 1413 to be burnt to death for heresy but he escaped from the Tower of London and led an unsuccessful conspiracy to seize the King and establish a commonwealth In 1415 he took part in another plot but was captured two years later and hanged and burnt in St Giles's Fields He figured in the old play *The Famous Victories of Henry V* on which Shakespeare based his *Henry IV* but the name of Falstaff was substituted in 1493 when that play was printed He was regarded as one of the first English martyrs for religion

Old Catholics, a sect which arose as a result of the protest of certain Roman Catholics led by Dr Döllinger of Munich against the definition of Papal Infallibility by the Vatican Council in 1870 After a public repudiation of the definition at Nürnberg in the same year Döllinger was excommunicated and in 1871 at a conference of his supporters his position was affirmed The church had followers in Germany Holland Switzerland and to a less extent in France and received some support from the secular authorities in

the former countries in the expectation that the movement would be wider than it in fact turned out to be Old Catholic communities still exist in certain European countries but the movement has not grown They are in friendly relations with the Church of England

Oldenburg republic of Germany consisting of the three geographically disjoined territories of Oldenburg Lübeck and Birkenfeld The first of these extends from the North Sea to Hanover the second is a small E portion of Holstein and the third is a district immediately N E of the Saar The chief rivers are the Weser the Ilante and the Hase The surface is flat and in places marshy On the moorlands large numbers of rather coarse-wooled sheep are kept There are no minerals of value and the main industries chiefly carried on at Oldenburg the capital are leather manufacture and brewing and textiles There is a fairly brisk trade with the city of Bremen Under the republic established in 1918 government is administered by a single elected House the Landtag consisting of 46 members elected every 3 years Area 700 sq m pop 640 000

Oldham industrial town in Lancashire The textile industry is of pre-eminent importance and others of note are engineering and metal founding The growth of the town is modern and the principal buildings are the Town Hall Library and art gallery Pop (1931) 140 300

Oldham, John (1653-1693) English satirical poet wrote in imitation of Juvenal His *Jovens and Translations* appeared in 1693

Old Maid a card game for any number of players The Queen of Hearts is removed from the pack of 52 cards and the remainder are dealt Any pairs (e.g. 2 Tens 2 Queens) in a hand are laid face downwards on the table Each player in turn then offers his cards, face down, to his left hand neighbour who draws one at random Pairs are discarded as soon as they

and play continues till all cards have been paired, except the odd Queen, the holder of which is "Old Maid"

Old Man's Beard, see CLEMATIS

Oldmixon, John (1673-1742), English historian, was the author of several works of little merit and of a *Critical History of England* (1726). He is best known as one of the victims of Pope's satire in the *Dunciad*.

Old Pretender, The, see PRETENDER, THE OLD

Old Red Sandstone, see DEVONIAN SYSTEM

Old Testament, the collection of Jewish sacred writings constituting, with the New Testament (*q.v.*), the Christian Canon of sacred literature. It is made up, in the version used by Protestant Christians, of 30 books, its contents being the same as those of the Hebrew Bible, though differently classified. The version in use by Roman Catholics (the Vulgate and the translations therefrom) includes certain other writings which do not form part of the Jewish Canon and to which Protestants grant only a minor degree of authority (*see APOCRYPHA*)

The language of the original was Hebrew, save for a few small portions which were written in Aramaic. By the Jews the Old Testament is divided into three parts, (i) the *Law* (*Genesis* to *Deuteronomy*), (ii) the *Prophets* (considered as 8 books, *i.e.* *Joshua*, *Judges*, *Samuel*, *Kings*, *Isaiah*, *Jeremiah*, *Ezekiel*, the *Minor Prophets*), (iii) the *Writings* (eleven books, *i.e.* *Psalms*, *Proverbs*, *Job*, *Solomon's Song*, *Ruth*, *Lamentations*, *Ecclesiastes*, *Esther*, *Daniel*, *Ezra*—including *Nehemiah*—and *Chronicles*. The modern division into chapters is not earlier than the 13th cent. A.D., and is said to have been made by Hugh of St. Cher. The verse divisions date from the 15th cent.

The separate books of the Old Testament are dealt with in this work under their own titles. Modern criticism has shown that traditional belief as to their authorship and date of com-

position can seldom be substantiated, perhaps the earliest of the separate books is that of Amos, which was written in all probability c. 750 B.C., while parts of the Psalms may well be as late as the 2nd cent. B.C.

The first translation of the Old Testament into another language was probably the Septuagint (*q.v.*) made for the benefit of the Greek-speaking Jews of Egypt in the 3rd cent. B.C. See also *BIBLE*.

CONSULT Hastings, *Dictionary of the Bible*, G. F. Moore, *Introduction to the Old Testament*, C. F. Kent, *The Student's Old Testament*

Oleaceæ, family of trees or shrubs, typified by the olive and including the privet, jasminc, ash, and lilac (*qq.v.*). The branches often end in conspicuous buds, and bear opposite, simple or compound leaves and clusters of flowers. There are about 500 species, many of which occur in the E Indies.

Oleander, flowering shrub belonging to the family Apocynaceæ, with long dark-green leaves and a woody stem and fragrant white, cream, or rose flowers. It is a greenhouse shrub, introduced about 1600 from the East, and requires an enriched sandy loam soil and a temperature of about 55° F. It is propagated by cuttings.

Oleasters, hardy deciduous and evergreen shrubs introduced into Britain in 1633, the evergreen from China and Japan, the deciduous from America, for their ornamental leaves, which are green or variegated with white. They grow in ordinary soil in open and fairly dry situations, and are propagated by cuttings made in Sept and begun in sandy soil in a cold frame.

Olefines, generic name given to unsaturated hydrocarbons of the aliphatic series which contain one double bond. They possess the general formula C_nH_{2n} and are designated by the termination "ene". In many ways they resemble the paraffins (*q.v.*), but chemically they are considerably more reactive. (Methylene, CH_2 , is unknown in the free state and exists only in the form of a radical.) The lowest

members of the series from C₄ to C₈ are gaseous those from C₉ to C₁₁ are liquids whilst the higher members are solid.

Oleum, the Latin word for oil is often applied to fuming sulphuric acid that is sulphuric acid containing dissolved in it free sulphur trioxide. See also SULPHURIC ACID.

Oligarchy government by a limited number of persons as opposed to democracy (govt. government by all classes) and monarchy (government by one person). The term includes aristocracy (govt.). In ancient Greece there was a wide cleavage between the oligarchic States led by Sparta and the democratic States led by Athens (see GREEK HISTORY). In effect all modern governments which are not dictatorships tend to become oligarchies since the real power becomes concentrated in the hands of a small body of influential persons but in a modern democracy this small body has no security of tenure. Plato used the word to signify government by the wealthy for their own benefit in contrast to aristocracy or impartial government by the best citizens.

Oligocene System rocks deposited during the second period of the Tertiary era between the Eocene and Miocene (q.v.) often difficult to distinguish. Oligocene deposits in England are limited to the Isle of Wight and the adjoining mainland a small deposit of limestone in the Isle of Purbeck and a small isolated patch at Bovey Tracey in Devon. The typical succession in Hampshire is as follows:

Lippe Hamstead Bed	Bl. cl. y	M. ls.
Low Hamstead Bed	Black and green l. y	Estuarine and freshwater
Bembridge Beds	Marl & d. limestone	Freshwater
Osborne Bed	Pal. marls	Freshwater and brackish
Upper Howdon Bed	Sand & ls.	Freshwater
Middle Howdon Beds	Limestones	
	Sa. dy green clay	Marl

These beds represent only the lower

part of the continental Eocene. They resemble those of France where however the succession is complete and includes the Fontainebleau Sands. In Belgium and Germany there is a good development of Oligocene the German deposits including the famous Baltic amber and the Brown Coal. Only the lowest Oligocene is developed in the Alps. Oligocene beds are found in the Pyrenees Carpathians Balkans and S. Russia whence they stretch through Persia and India to Burma.

Fauna of the Oligocene and Eocene were similar. Mammals are chief fossils. The ancestors of the rhinoceros horse and elephant appeared at this time and fossil carnivores are important. Of the invertebrate mammals were still the most important zonal fossils and were accompanied by corals.

Oliphant Laurence (1820-1888) British author was born at Cape Town and for a short time practised at the colonial Bar. In 1851 he went to Nepal and published in the following year *A Journey to Kathmandu* giving an account of his tour. He then travelled in Russia and wrote *The Russian Shores of the Black Sea* 1853. He was secretary to Lord Elgin in Canada in 1853-4 and later in China. In 1860 he was successful with a novel *Piccadilly* and in 1871 was correspondent for *The Times* during the Franco-Prussian War. In 1884 he wrote *Symposiums* in collaboration with his wife and in 1888 *Scientific Religion*.

Olive small tree belonging to the family Oleaceae. The wild olive is thorny but in the cultivated state the thorns are lost while the mode of growth becomes more compact. The typically oval fruit dark when ripe forms when unripe the familiar article of dessert. It also yields olive oil for which purpose it is allowed to ripen. It is usually propagated by cuttings or layers which are planted in rows at intervals and well pruned as they develop. It flourishes best on calcareous soil near the Mediterranean.

Olive-oil, a fatty non-drying oil obtained by expression or extraction from the pericarp (pulp) of the olive. The principal use of olive-oil is as an edible oil, it forms the greater part of European salad oils and is also used as a butter substitute in some Mediterranean countries. In medicine the oil is used both externally and internally as a soothing and emollient agent, and also for feeding by subcutaneous injection.

Olives, Mount of, low hill near Jerusalem, rising above the Vale of Kidron. It is famous for its Biblical associations, as the Garden of Gethsemane is at the foot, and traditionally the Ascension took place from the peak.

Olivine, name for a group of rock-forming minerals, which are silicates of iron or magnesium or both, and are characteristic of basic rocks or crystalline limestones. Olivine itself is silicate of iron and magnesium, and, as its name implies, occurs usually in olive-green crystals, rarely brown, or in masses.

Olympia, famous Greek religious, political, and athletic centre, where the Olympic games were held, is on the N bank of the Alpheus (Ruphus), below the sacred Cronion Hill. It was a place of worship from c. 1000 B.C., and the games grew up as a festival in honour of Zeus. The organisation of the worship and the games, both of which assumed a national importance, made its administration a political matter in which the Eleans, Spartans, and earlier the Pisans all took part between 776 B.C. and 393 A.D. By the 5th cent. A.D. earthquake, pillage, and neglect had desolated the site.

Archaeologists began excavations in the late 19th cent. The principal discoveries have been the great altar, where divination and other practices took place, the Pelopium, a small building in which sacrifices were offered to Pelops, the temple of the Great Mother of the Gods, the Heraeum or Temple of Hera, and the Temple of Zeus. The stadium has been cleared

sufficiently to show the various entrances, the starting lines, seating accommodation, and the drainage. The Hippodrome chariot-racing stadium has been covered by the river. See also ATHLETIC SPORTS, GAMES, GREEK Olympic Games, see ATHLETIC SPORTS, GAMES, GREEK

Olympus, the name of several mountains in Greece and Asia Minor. The best known is Mt Olympus in Thessaly (9754 ft.), separated from Mt Ossa, by the Vale of Tempe. This mountain was the fabled home of the gods, under the supreme rule of Zeus. In the war between the gods and the Titans the Titans piled Pelion on Ossa in a vain attempt to reach the summit of Olympus. The twelve deities dwelling on the mountain were Zeus, Apollo, Hermes, Poseidon, Ares, and Hephaestus (gods), and Hera, Athena, Demeter, Aphrodite, Artemis, and Hestia (goddesses).

Omaha, American city in the State of Nebraska, on the Missouri R. It is a busy river-port, a great railway centre, and has many large industries, among which meat-packing, flour-milling, dairy produce, and metal-founding are the most important. It exports agricultural produce. Pop. (1930) 214,000.

Oman, Sir Charles William (b. 1860), English historian, has represented Oxford University in Parliament since 1910. His works include a *History of Greece* (1890), *A Short History of England* (1895), which is a familiar school-book, and a *History of the Art of War in the Middle Ages* (1898).

Omar Khayyám (d. A.D. 1123), Persian astronomer and poet, was famous in his own day for his mathematical skill and for his revision of the calendar. But his present fame in England and America rests on Edward FitzGerald's translation of his *Rubáiyát*, a collection of some 500 epigrams, songs, and reflections. East-Asian fatalism, hedonism, and melancholy inform this work, which has been set to music by Granville Bantock.

Omdurman, Battle of (Sudan Cam-

paign) Sept 2 1899 23 000 British and Egyptian troops under Sir Herbert (Lord) Kitchener defeated 50 000 Dervishes under the Khalifa with great slaughter of the Dervishes

Omelets, to make

Omelet Savoury

- eggs

1 oz butter

Seasoning

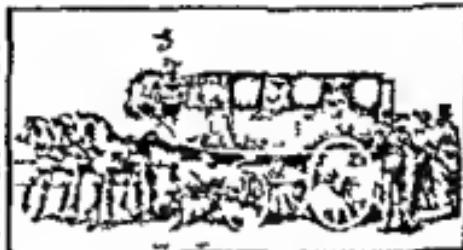
Flavouring (chopped parsley herbs etc)

English Heat butter in proved (see *HEATING PAN*) omelet pan until frothy. Pour in slightly beaten egg with seasoning and flavouring. Stir slowly until beginning to set. Smooth the surface, fold in three and brown slightly. Serve at once. Solid additions such as ham and mushrooms should be folded in.

French Heat butter until frothy. Pour in beaten egg with flavouring and seasonings. Stir with fork keeping sides well turned into the centre when omelets begins to set tilt pan and form egg mixture with a knife into an almond shaped mass. Brown slightly underneath. Turn out on to hot dish by inverting pan over it.

Omnibus (Lat. *for all*) a public passenger-carrying vehicle. Although a public vehicle for the upper classes made regular journeys in Paris from 16th c. the modern omnibus was first used in Paris in 18th c. and introduced to London by Shillibeer in the following year when one ran from Paddington to the Bank carrying 20 passengers. Outside seats were added to these horse-buses which soon became common in towns all over England. The London General Omnibus Company which existed as an independent concern from 1856 until its absorption into the London Passenger Transport Board in 1933 did a great deal to perfect omnibus design and organisation. A double-decked motor-omnibus was introduced in 1904, a covered-deck model in 1911 and a 6 wheeler in 1931. There are about 6 500 buses in London which carried about 1960 million passengers in 1933. The omnibus has

in recent years on account of its greater mobility tended to oust the tram-car as a means of transport in populous centres and has also become a serious rival to the rail as a means of linking up market towns and trading centres with their dependent villages. See also *Road Transport*



Shillibeer Bus from *Co Temperary Print*

LONDON PASSENGER TRANSPORT BOARD

Omsk Siberian town at the confluence of the Omsk and Irtysh. It is a river port of some note and exports meat, butter skins and similar local produce. In appearance it is still decidedly primitive but manufacture of foodstuffs and cloth have developed. The population has increased and stone buildings and various municipal amenities have been introduced. Pop 178 000

Onagraceous (bot.) a family of herbaeous plants or shrubs inhabiting the temperate parts of Europe and America and including evening primrose, fuchsia and enchanter's nightshade.

O'Neill, Eugene (b. 1888) American playwright spent his early life gold prospecting, sailing and at sea and travelling about N and S America. His early plays appeared as *The Moon of the Caribees and other Plays* (1919) *Beyond the Horizon* (1920) which won the Pulitzer Prize gave some indication of his promise which was realised in *The Emperor Jones* (1911). *The Hairy Ape* (1922), *The Great God Brown* (1925) and *Strange Interlude* (1928) are other unusual plays of a similar type. *Anna Christie* (1922) and *Dresser under the Elms* (1924) are realistic plays in his earlier style.

Onion, a triennial bulbous plant with long narrow leaves and purple flowers in heads, one of the most useful members of the Liliaceæ and one of the first plants to be cultivated. It originated in W Asia and is now grown all over the world. A rich soil is essential, well dug and with plenty of stable manure and rotted leaves, basic slag and kainite may also be given.

Onions, Oliver, English novelist, the author of *Widdershins*, *In Accordance with the Evidence, A Case in Camera*, *Peace in Our Time* (1923), *Cut Flowers* (1927), and many other novels.

Ontario, principal province of Canada, bounded N by Hudson Bay, S by the St Lawrence R., the Great Lakes, and Minnesota, W by Manitoba, and E by Quebec. A line of hills crosses it N of Lake Superior, extending in an arc to the W. The ground falls gradually N and S, forming low plains around Hudson Bay and the St Lawrence. Several rivers, of which the Albany is the most important, flow N, those to the S are tributaries of the St Lawrence, the Ottawa being the chief. A number of smaller lakes contribute to the excellent water supply. The climate varies considerably, but is always healthy. Rainfall is plentiful, and general conditions are well suited to agriculture. Fruit cultivation, tobacco, and cereal growing are of primary importance, and the great herds of cattle support a thriving dairy industry. Nickel, gold, silver, copper, petroleum, mica, graphite, and several other minerals yield a large annual revenue, and there are great mineral deposits unexploited. Ontario leads also in manufactures—flour-milling, meat-packing, paper-making, saw-milling, metal-founding, and the making of agricultural and other machinery.

Chief towns are Ottawa (Dominion capital), Toronto (Provincial capital), Hamilton, Kingston, and London. Communications are excellent, especially in the S, and education is at a high standard, being compulsory up to

the age of 16. There are several universities, of which that at Toronto is chief, and a number of technical and agricultural schools. Area, 412,262 sq m. pop (1931) 3,426,500.

Ontario, Lake, one of the Great Lakes of N America, fed by the Niagara, Oswego, Trent, Black, and Genesee Rs and united to the other lakes by the Welland, and Trent Canals, the natural waterway being blocked by the Niagara Falls. The lake is a valuable means of communication, is deep and easily navigable and has its ports closed by ice only in the depth of winter. The chief Canadian ports are Toronto, Hamilton, and Kingston, the American ports are Oswego and Sackett's Harbour. Area, 7580 sq m.

Onyx, see CHALCEDONY; GEM
Oogamy, see ALGÆ

Oolite [ō-lītē], term for a limestone or ironstone made up of small round grains resembling a fish's hard rock, the precipitation of the iron or calcareous matter being variously ascribed to organic or inorganic agencies, and the spherical shape to the particles having been rolled about by waves and currents during precipitation. They furnish important building stone, and the Middle Jurassic deposits were formerly called "Oolites," as a stratigraphical term.

Opal, hydrated silica, occurring in massive, or in compact or stalactitic form, but never crystalline. It may be almost any colour, which changes and blends in many cases according to the direction from which the stone is viewed, and may show beautiful iridescence, in which case it is termed "precious opal" and is a gemstone. Opal occurs in cracks in igneous rocks probably having been deposited from solution in hot waters.

Open Field System, a method of farming practised from the time of the Conquest until the 16th cent. Each manor possessed three large open fields, which went through the following series of crops in rotation—wheat or rye for bread, barley for beer, and

loughed fallow to rest the soil. At any given time a balanced crop was therefore obtainable while the soil was never overworked. Each field was divided into small strips of $\frac{1}{4}$ -1 acre divided by unploughed ridges. There are a few small areas in Nottinghamshire and Oxfordshire where the system is still followed.

Open Market Operations see BANK OF ENGLAND

Openhearth Steel, see IRON AND STEEL.

Opera, a drama set to vocal and orchestral music.

The origins of opera date from Greek days when the actor declaimed his words to an accompaniment of flutes and lyres. Its evolution into its modern form began when two Florentine composers of the 16th cent. Peri and Caccini attempted to combine music and drama.

Monteverde is the first really important operatic composer. His *Orfeo* produced near the beginning of the 17th cent. made a great impression on the musicians of his time who saw in this form an attractive and new medium for their talents. The idea of opera began to attract musicians throughout Italy and soon spread to France, Germany and England. The first opera house was opened at Venice in 1637 and a school of Venetian operatic composers was formed which was soon imitated in Naples and Rome. In France and England Lully and Purcell arose the latter producing many works of the highest originality and variety.

With the Neapolitans of the period of Scarlatti (1699-1750) we find the vocal operatic parts developed into the conventional recitative and aria form and in *La Serva Padrona* of Pergolesi (1710-1736) an opera buffa we see a comic opera attracting enough attention as far away as Paris to rouse a sharp controversy for and against the buffa school.

By the middle of the 18th cent. the artistic development of opera had come to a standstill. Opera had become largely an excuse for vocal virtuosity

which certainly reached its highest peak at that time. With the coming of Gluck however it again began to make progress. This composer brought to bear on the decadent opera of the period many revolutionary ideas which he carried out in a masterly fashion in *Aleste* and *Iphigénie en Aulide* the most important contributions to opera since Monteverde. Gluck was able largely to purify the French school of opera and to abolish the inartistic practices that had originated in Italy. Mozart's contributions to the history of opera included three immortal masterpieces—*Figaro*, *Don Giovanni* and *Die Zauberflöte* (*The Magic Flute*).

The modern German and Italian schools reached their highest development with Wagner and Verdi respectively. With Wagner Gluck's ideals were fulfilled in the music drama. In his great operas Wagner though showing superb understanding of the capabilities of the human voice makes of it a thread in his wonderfully woven orchestral texture. The Ring cycle together with *Tristan* and later *Parsifal* mark the peak of operatic achievement.

In Italy Verdi started by writing operas such as *Ernani* (1844) and *Luisa Miller* (1849) which though showing great talent were in the accepted Italian style and broke no fresh ground. The next operas however showed an ever growing dramatic sense that was new in Italian music. *Un Ballo in Maschera* (1859) is the most typical of this transitional period which culminated in *Aida* (1871).

Verdi was succeeded by Puccini and Wagner by Richard Strauss. Puccini wrote some very charming and singable melodies and was a clever orchestrator. *Madam Butterfly* and *La Bohème* well deserve their popularity.

Strauss is best known for his *Rosenkavalier* which with its delicious waltzes the subtle and beautiful music sung by the ageing Marschallin and the wonderful final trio has a firm hold on the affections of opera goers.

TABLE OF FAMOUS OPERAS
WITH DATES OF FIRST PRODUCTION

Opera	Composer	First Produced	Opera	Composer	First Produced
Aida	Verdi	1871	Macbeth	Verdi	1847
Alceste	Gluck	1767	Madam Butterfly	Puccini	1901
Arabella	R. Strauss	1931	Magic Flute, The	Mozart	1791
Ariadne auf Naxos	R. Strauss	1912	Manon	Massenet	1884
Barber of Seville	Rossini	1816	Martha	Flotow	1817
Bohème, La	Puccini	1897	Masked Ball, The	Verdi	1858
Boris Godunov	Moussorgsky	1874	Mefistofele	Boito	1868
Carmen	Bizet	1875	Meistersinger von Nürnberg	Wagner	1868
Cavalleria Rusticana	Mascagni	1890	Mignon	Thomas	1866
Cid, Le	Massenet	1885	Nibelungs, The Ring of the,		
Cosi Fan Tutte	Mozart	1790	see Rheingold, Das		
Don Carlos	Verdi	1867	Walpurg, Die		
Don Giovanni	Mozart	1787	Siegfried,		
Don Pasquale	Donizetti	1843	Götterdämmerung		
Elektra	R. Strauss	1909	Norma	Bellini	1831
Elisir D'Amore	Donizetti	1832	Oberon	Weber	1826
Ernani	Verdi	1844	Orfeo	Monteverde	1608
Eugen Onegin	Tschalkovsky	1877	Otello	Verdi	1887
Euryanthe	Weber	1823	Pagliacci	Leoncavallo	1892
Falstaff	Verdi	1892	Parisifl	Wagner	1882
Faust	Gounod	1859	Pelléas et Mélisande	Debussy	1902
Fidelio	Beethoven	1805	Prince Igor	Borodin	1871
Figaro, Marriage of	Mozart	1786	Rheingold, Das	Wagner	1869
Fiedermaus, Die	J. Strauss	1874	Rienzi	Wagner	1842
Flying Dutchman, The	Wagner	1843	Rigoletto	Verdi	1851
Freischütz, Der	Weber	1821	Robert the Devil	Meyerbeer	1831
Gianni Schicchi	Puccini	1918	Rosenkavalier, Der	R. Strauss	1911
Götterdämmerung	Wagner	1876	Salome	R. Strauss	1905
Hansel and Gretel	Humperdinck	1893	Samson and Delilah	Saint-Saëns	1877
Hoffman, Tales of	Offenbach	1881	Siegfried	Wagner	1876
Huguenots, Les	Meyerbeer	1836	Tannhäuser	Wagner	1845
Idomeneo	Mozart	1781	Tosca, La	Puccini	1900
Intermezzo	R. Strauss	1924	Traviata, La	Verdi	1853
Iphigénie en Aulide	Gluck	1774	Tristan and Isolde	Wagner	1865
Juive, La	Halévy	1835	Trovatore, Il	Verdi	1853
Life for the Tsar, A	Glinka	1836	Turandot	Puccini	1926
Lohengrin	Wagner	1850	(completed by Alfano)		
Lucia di Lammermoor	Donizetti	1835	Village Romeo and Juliet, A	Delius	1910
Lucrezia Borgia	Donizetti	1833	Walküre, Die	Wagner	1869
Luisa Miller	Verdi	1849	William Tell	Rossini	1829
			Wozzeck	Berg	1921

Of the modern French operatic composers Saint-Saëns scored the biggest popular success with *Samson et Dalila*, which is efficient if unoriginal, but an infinitely finer work is Debussy's *Pelléas et Mélisande*. Ravel's *L'Heure Espagnole* is another modern French opera which has been heard at Covent Garden.

Some of the finest contributions to

opera have come from Russia. Russian music, indeed, may be said to have had its beginnings in the opera of the first of the "Nationalist" composers—Glinka's *A Life for the Tsar* (1836), which was the earliest expression of the revolt against Italian influences. Dargomijsky, in *Russalka* (1856) and *The Stone Guest*, developed Glinka's nationalist theories, while putting into

practice some of his own and achieving a more naturalistic presentation of the dramatic action. A finer Russian work than any that had preceded it was Borodin's *Prince Igor*, that brilliant and colourful opera which has become so popular in Europe. But the greatest expression of Russian nationalism was Moussorgsky's *Boris Godunov*. Another Russian whose music glows with Oriental colour is Rimsky-Korsakov whose best known opera is *Sadko* (1899).

In England in recent years Holst (*The Perfect Fool*) Vaughan Williams (*Hugh the Drover*) and Eugene Goossens (*Judith*) have all had operas produced with varying success. The most outstanding is Debussy's *La flûte et Romeo and Juliet*, a lovely and typical work which was first produced by the Beecham Opera Company in 1910.

See Gustav Kobbe's *The Complete Opera Book* (1922), Grove's *Dictionary of Music and Musicians* (3rd ed 1927-30).

Opera glass a pair of telescopes of low magnifying power. The simplest type is the Galilean telescope with convex object glass and concave eyepiece. More expensive types are prism binoculars. *See also TELESCOPE*.

Opera, Light: Though the Grand operas that are performed in theatres like Covent Garden are by no means always solemn affairs (witness *Figaro Der Froschkönig*, *The Barber of Seville*) a great number of works to which the name light opera is given are seldom heard in the world's great opera houses. Under this head come some widely different types: the English ballad operas of the 18th cent., the operettas of Offenbach, Lecocq and Johann Strauss and the comic operas of Gilbert and Sullivan.

In such a collection it would not be difficult to select from the works of each composer one which could give points to some of the lesser works of more ambitious musicians. This does not strictly apply to the above-mentioned ballad operas as such

pastiche are in part the work of the great Dr Pepys who did not hesitate to go to the works of Purcell, Handel and others and lift from them what he wanted for the purpose of setting Gay's text of *The Beggar's Opera*.

To begin with the first mentioned work *The Beggar's Opera* has had two phenomenal runs of popularity in its history, on its first introduction in 1727 and two hundred years later when it was presented to a delighted modern audience. The natural successors to the 18th cent. ballad operas in England were not written till the 19th cent. when the combined talents of Gilbert and Sullivan bore such rich fruit. It was left to France to supply this country with light opera. Jacques Offenbach (1819-80) is known to the supporters of touring opera companies by one work, *Tales of Hoffman*, and particularly by one extract from that work the ineluctable Barcarolle. Another Frenchman Alexandre Charles Lecocq (1831-1918) though not so consistent in the quality of his operettas as Offenbach produced one work that was superior to any of the latter's in *La Fille de Madame Angot*.

All the above mentioned operettas resemble each other in that they stand or fall by their music the libretto in each case being definitely a secondary consideration. But in the remarkable collaboration of Gilbert with Sullivan the verbal ingenuity of the one vies in interest with the musical facilities of the other. When Sullivan's genius flags we can concentrate on Gilbert's wit and when the latter becomes too mordant or his humour a trifle jaundiced we can turn our attention to Sullivan's skilful setting of his partner's satirical verses.

Ophicleide, an obsolete brass musical instrument whose function is now more efficiently performed by the bass tuba. *See ORCHESTRA.*

Ophidua, the zoological name for the snakes (q.v.) an order of reptiles differing from the lizards in the absence of eyelids and an external ear-opening

and in the separation of the two halves of the lower jaw so that the mouth can be more widely opened for swallowing prey

Ophir, a region, unidentifiable in modern geography, mentioned in the Old Testament for its riches. Many surmises as to its situation have been made, and places as far distant as India and Peru suggested. A few years ago the ruins at Zimbabwe in E Africa were believed to be those of the city, but the claim was substantially disproved, other suggestions have been Abyssinia, farther India, and Arabia, of which the last seems the most likely.

Opie, John (1761-1807), English painter, born in Cornwall. Opie had received practically no tuition in art when he came to London in 1780, and, with the aid of patronage, became very rapidly a fashionable portrait-painter. He later turned his attention also to historical subjects. He became R A in 1788. He is well represented in the National, Tate, and National Portrait Galleries.

Opiliones, order of Arachnida, including the Harvest-man (*qv*), differing from the spider in having an unjointed body.

Opium, a drug consisting of the dried milky juice obtained from the immature fruits of the poppy, *Papaver somniferum*. It is a complex mixture consisting of several alkaloids, resins, mineral salts, organic acids, and proteins.

The principal opium of commerce in England is known as Asia Minor opium. There are a large number of opium preparations of various forms prescribed in the pharmacopœia. The chief medicinal use of opium is as a reliever of pain and also as a hypnotic.

Opium is also widely employed especially in the East, as a euphorbic drug, the usual method is by inhalation, the drug being smoked.

Opium War, The: the name given to the war with China in 1840-2, brought about by the action of the Chinese authorities, who in 1839 had seized and destroyed the opium belong-

ing to British merchants in China with a view to the suppression of opium smuggling. It resulted in a treaty on Aug 26, 1842, whereby Hong Kong was ceded to Great Britain, and Canton, Amoy, Foochow, Ningpo, and Shanghai were opened as treaty ports. Also called "The First Chinese War."

Oporto, Portuguese town on the R Douro, a few miles from its mouth. In commerce it is second only to Lisbon. The University dates from 1837. It is chiefly famous as the centre from which port wine is shipped, but there are also large industries of textiles, clothing, soap, brewing, pottery, and tobacco. In addition to these the fisheries and the tourist traffic produce considerable revenue. The harbour is at Leixões, as a sand bar at the river mouth excludes large vessels from the town. Pop (1930) 232,400.

Opossum, a family of mainly carnivorous or insectivorous, and arboreal marsupial mammals (*qv*), ranging in America from the latitude of New York to the Argentine, and differing from the Australian marsupials with similar habits by having the first toe of the hind foot prehensile. The typical species, found in N America, is as large as a small cat and is a voracious creature, eating fruit, eggs, carrion, and any small animals it can catch, and is a great enemy to poultry. The pouch, however, is not present in all species. It is absent, for instance, in the mouse opossum, a small species from tropical America.

Oppeln, a town in Prussian Silesia, on the R Oder, some 25 m SE of Brieg. There are breweries and lime kilns, and cement, cutlery, machinery, and cigars are manufactured. Its trade also includes cereals and cattle. The town was laid waste by the Tartars in 1260 and, after its restoration, came into Austrian possession in 1532. It was acquired by Prussia in 1742. Pop 45,550.

Oppenheim, Edward Phillips (b 1866), novelist, author of *A Prince of Sinners*, *The Kingdom of the Blind*, *The Great Prince Shan*, *The Wrath of*

Come Slants & Long Shots and many other stories including detective fiction

Optical Activity a property possessed by numerous chemical compounds chiefly those belonging to the organic series. It is the power of rotating either to the left (laevorotatory) or to the right (dextro rotatory) the plane of polarisation of light (see POLARISED LIGHT). See also STEREO CHEMISTRY.

Optical Illusion occurs when the mind draws incorrect conclusions from data given it by the sense of sight. A few well known illusions are readily explained by defects in the eye (q.v.) as

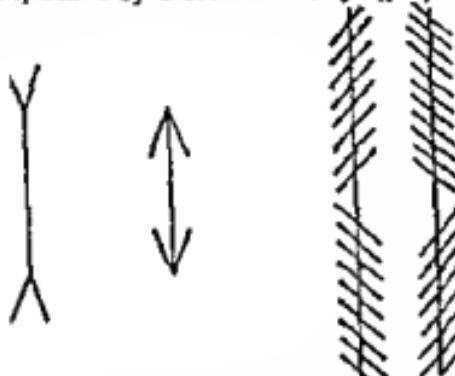


Fig. 1.—The two illus. on the rt. of the page give the illusion that the right are parallel. In which case does this prove to be so?

an optical instrument. Most remarkable are the illusions which result from the mind drawing false conclusions from data which are correct. Two of the commonest of these are illustrated in Fig. 1, many others being known to architects.

Again if a column be made with perfectly straight sides converging slightly it appears contracted in the middle and hence a well-designed column is given a slight bulge outwards. Straight lines such as the edge of a roof or any lines forming a vista appear bent to the eye. These facts were known to all ancient architects and no Greek temple or Gothic cathedral is built with truly straight or parallel lines.

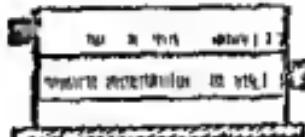
Persistence of vision enables the illusion of motion to be presented to the eye by the cinematograph. The series of single pictures representing



Fig. 2.—The arrangement of mirrors and the order of their reflection will show that the eye will see a moving object placed in the path of the light. The lines of sight will actually come from the distant object.

successive stages of a motion is blended by the eye into a smooth effect. The pictures must be presented at a minimum rate of 16 per second if they are completely intermittent with periods of darkness between them.

The conjurer and entertainer have made great use of optical illusions though these are nearly all planned so as to deceive the eye and do not depend upon the eye deceiving itself. Periodically the X-ray apparatus (Fig. 2) and the money printer (Fig. 3) are produced as toys. Use is constantly made of mirrors in stage illusions. An instance of a stage illusion produced by mirrors may be given as follows. On the stage we have a chamber 12 ft square formed by flat walls with 2 doors exactly similar to one another. The room is masked by dark curtains and lit by footlights.



END SECTION

Fig. 3.—Conjurer's money printer. Bills prepared to be rolled are run into the back shown by end section on right. A belt of bills is kept perpendicularly at one end and rolled up in the back whilst previously placed note emerge on the other side creating the desired illusion.

A specially prepared mirror can be run on rails from the side of the stage along a dotted line. There is a round table with a cut in it into which the

edge of the mirror fits the edge of the mirror on the side towards the table has the silvering removed in vertical strips, which become narrower and narrower. The mirror can be slid so as to move towards the table and finally take up a position such that on looking into it the spectator sees reflected in the mirror the one of the two doors nearer to him, which he takes to be the other door, the mirror is in fact completely invisible, since it reflects a view precisely similar to what is behind it. When it is slowly moved in position, a person standing behind it appears to slowly vanish. If the person is sitting on a chair a similar chair can be placed in a similar position, and as the person vanishes, the reflected chair is seen. Many amusing tricks can be played with this apparatus, it is even possible to transform one person into another by placing them in suitable positions.

Optical Isomerides, compounds which, whilst having the same empirical formula and a very closely related structural formula, differ from one another in their optical behaviour. Such substances usually (though not always) behave chemically in a very similar manner. See STEREOCHEMISTRY.

Optics The first elementary law of geometrical optics is the *law of reflection*, according to which the angle at which

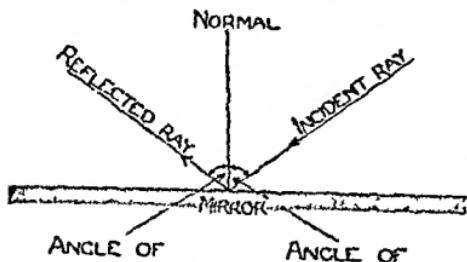


Diagram illustrating the Law of Reflection

a ray of light reflected from a surface is equal to the angle of incidence, that is, the angle at which the ray falls on the surface. These angles are measured with regard to the perpendicular to the surface at the point where reflection

takes place, and the law further states that the incident ray, the perpendicular, and the reflected ray are in the same plane.

The *law of refraction*, the bending of a ray of light in passing from one

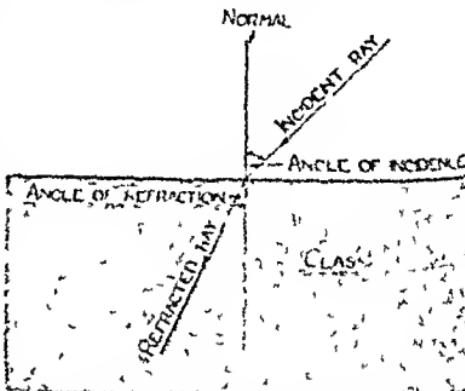
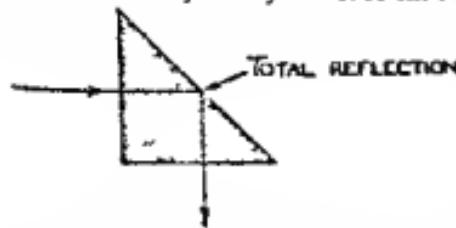


Diagram illustrating the Law of Refraction

medium to another, is also stated with reference to the angles made by the incident and the refracted ray with the normal to the surface, the law states that the ratio of the sines of these two angles is constant. This ratio is called the *refractive index*, when a ray of light passes from a vacuum into a transparent material medium, such as water or glass, the index of refraction is always greater than 1, and is a constant characteristic of the material. In such a case the ray is always bent towards the normal. In passing in the other direction the ray follows the same path, it is bent away from the normal. In this direction a very curious thing happens when we make the angle of incidence greater and greater. At a certain angle of incidence, called the *critical angle*, the refracted ray is finally bent at right angles to normal, and if we increase the angle of incidence beyond this, the light no longer passes into the second medium, but is totally reflected back into the denser medium instead. Some part of the light is always reflected in every case of refraction, the percentage increases with the angle of incidence, and becomes

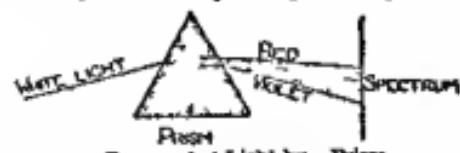
100 per cent at the critical angle. This is made use of in the *Total Reflection Prism* (see Fig.) but is familiar to everyone by the fact that a



Total Reflection by Prism.

sheet of window glass forms quite a good mirror when seen at a very oblique angle. It can be shown that the ratio of the velocity of light in one medium to that in another is given by the refractive index for light passing from the first to the second.

If we add to the above the fact that the refractive index varies with the wave length (that is the colour) of the light being normally greater the shorter the wave length we have the whole basis of the theory of mirrors lenses and prisms the rest being a matter of geometry and trigonometry. The prism is a piece of transparent substance having two sides which are not parallel. A ray of light striking one of these sides in any direction except the normal is bent towards the latter and on emerging from the prism to the other side is bent again in the same direction. If the incident ray and the emerging ray make the same angle with their respective normals the deviation is a minimum. If the incident ray is a mixture of light of different wave lengths it is broken up or dispersed in passing through the

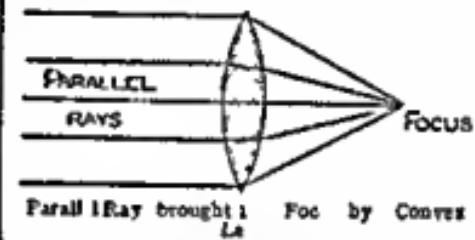


Dispersion by Prism

prism since the refractive index for each wave length is different. White light from the sun or an incandescent electric lamp is drawn out into a con-

tinuous band of colours called the *spectrum*. These are frequently termed violet, indigo, blue, green, yellow, orange and red the last being least bent and the violet most. It is easy to show that beyond the violet there are *ultra-violet rays* and below the red *infra-red rays* both invisible to our eyes but affecting us physiologically.

A *lens* (q.v.) may be regarded as a series of prisms designed so that rays of light emitted from a point on its axis are brought together at another point on its axis called the *focus*. Along the axis of the lens the front and back surfaces are parallel and the ray is not bent. As we go farther from the axis the rays are bent more and more. If a parallel beam of rays falls on the lens it is brought to a focus at a point

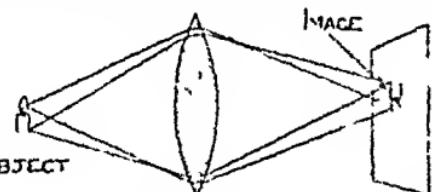


Parallel Ray brought to Foc by Convex Ls

the distance of which from the lens is called the *focal length*.

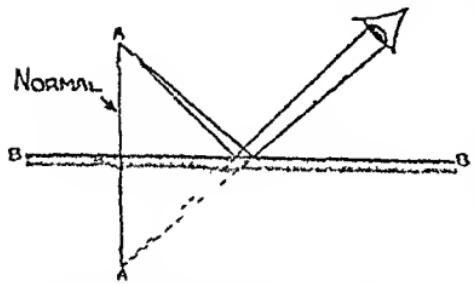
We see objects because they throw back to our eyes some of the light which falls on them. A perfect mirror surface throws off light coming from a single direction in another single direction only but all other surfaces scatter it in all directions. As a rule they also absorb a great part of it. A piece of white paper scatters white light in all directions absorbing very little of it. A piece of red paper absorbs all the colours contained in white light except the red which it scatters and so on for all coloured objects. If we place an object in front of a lens the latter will catch some of the rays scattered from each part of the object and bring them to a focus at a point on the other side of it. These points will be approximately at the same distance from the lens and if

we put a white screen at this distance, we shall see on it an image of the object, such as we see on the focusing screen of a camera. Unfortunately, the



Production of a Real Inverted Image by a Convex Lens

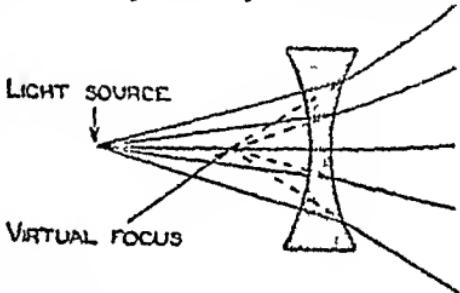
rays of different colour are unequally bent by the lens, and the focus of a simple lens for light of one colour is different from that for light of another. Hence a lens will not form a sharp image on a screen with white light, it suffers from *chromatic aberration*. It is also necessary to make the surfaces of a lens spherical in shape, and this shape is not theoretically correct, the resulting defect is called *spherical aberration*. A lens to be used for forming a sharp image on a photographic film or a cinema screen must be constructed so that that image is formed on a plane surface, this again is a condition which cannot be perfectly fulfilled. Another problem is presented by the fact that only the light from near the axis of the lens falls upon it in a perpendicular direction, a further defect, *astigmatism*, is its imperfect behaviour towards light



Production of a Virtual Image by a Mirror falling on it obliquely. The image formed by any real lens is thus never perfectly in focus all over, or entirely free from distortion. The eye (*q.v.*) is

itself constructed like a simple type of photographic camera, and suffers from all the optical defects.

The images so far considered are *real images*, characterised by the fact that they can be received on a screen. An ordinary mirror forms an image which cannot be thus received, and is called a *virtual image*. No rays of light actually proceed from a virtual image, but light somewhere else behaves as if it were coming from the image. In the figure, the point A is sending out light to the mirror B, and each ray is reflected as shown. These reflected rays diverge from one another, but if we imagine them produced through the mirror backwards, they meet at a point A' just as far behind



Rays brought to a Virtual Focus by a Concave Lens

the mirror as A is in front of it. If we look along them, they affect the eye in exactly the same way as if they were really coming from A', and we have the illusion that A is at A'. In the same way, a concave lens does not bring a parallel beam of rays to a focus, but causes it to diverge. It thus brings them to a *virtual focus*. If instead of parallel rays we have rays proceeding from a distant object, the concave lens seems to bring that object nearer to an eye receiving the rays passing through the lens, hence, a short-sighted person uses concave spectacles.

Diffraction is a result of the interference of light of different phase. The proper treatment of this subject can only be mathematical, but a simple case is shown in the figure. A parallel beam of light is sent through two fine

its close together and received on a screen. The slits do not form sharp-edged bright lines. The light spreads and if the slits are close enough together the light from one interferes on the screen with the light from the other. At a point equidistant from the two slits on the screen the waves arrive in phase and reinforce one another. At a point on either side of this one train of waves will have to pass over a greater distance than the other. If this distance is greater by half a wave length the result when they meet will be darkness. One wave exactly cancelling the other. At a further point there will be a whole wave length difference and they will reinforce one another.

Another wave phenomenon is polarisation. Light is a transverse vibration as explained under *Electromagnetic Radiation* and a ray of light is thus characterised not only by the direction in which it is travelling but also by a direction at right angles to this in which its electrical vibrations are taking place. Ordinary light is a mixture of vibrations in all possible directions. Certain crystals have the property of possessing a different refractive index for light polarised in two directions at right angles and split up a ray of light into two rays thus polarised (the ordinary and extra-ordinary ray). A properly cut Nicol prism of Iceland spar (see *CALCITE*) can be made

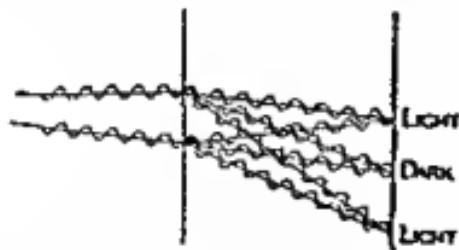
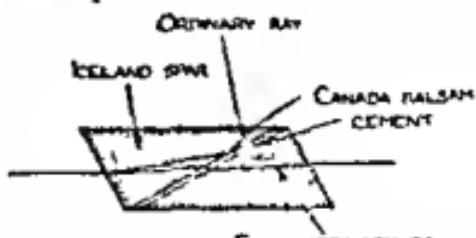


Diagram showing how Interference produces Diffraction

to pass only light polarised in one plane. If this light is passed to a second similar prism the latter will be found to stop it completely when set

in a position at right angles to the other prism. Various optical instruments e.g. Spectroscope, Microscope and Telescope are dealt with under their



EXTRAORDINARY RAY
Polarisation of Light by a Crystal of Iceland Spar

own headings. See also COLOUR FLUORESCENCE LEYS LUMINESCENCE PHOTOGRAPHY PHOTOMETRY QUANTUM THEORY SPECTRUM

See R. T. Glazebrook *Dictionary of Applied Physics* Vol IV Optics

Option, a contract which carries the right to buy shares or goods at a fixed price in the future (a call) or to sell them similarly (a put). Options are exercised by speculators on the Stock Exchange (q.v.) who anticipate a rise or fall and have not the money to buy shares outright. One who takes a

bull option in the belief that certain shares will rise calls a certain number at the current market price (say £10) for 6 months later. For this privilege he pays only a small deposit per share (say 10s) and is therefore enabled to call 20 times as many as he could have bought outright. If the shares rise £1 in the time stated he completes the purchase at £10 and sells at £12 but as he holds 20 times the number his profit is that amount greater than it otherwise would have been. Similarly one who anticipates a fall makes a bear option to sell a certain number at a future date at the current price (say £10). If the price falls £2 he buys them in the open market at £8 and sells at £10 again making a profit. If the speculator's anticipations are not realised his losses are again limited to the difference between the market price at the time of contract and that at its expiration.

A "put-and-call" option gives the right either to buy or sell, and costs twice as much as a single option. A "fancy" option is one in which the price mentioned is higher or lower than the current price.

Optophone, an instrument invented by Fournier d'Albc, by means of which the letters of ordinary print are caused to produce characteristic musical sounds by being projected optically upon a screen composed of a number of selenium cells connected to sources of alternating electric current of audio frequency and to a loud speaker which thus emits a sound composed of the notes transmitted by the various selenium cells. The object of this arrangement is to enable the blind to read ordinary print, the ear being sufficiently acute to distinguish between the sound given by each letter as it is successively thrown on the screen.

Orach, genus of herbs or small shrubs, often covered with a floury meal, widely dispersed and especially common in the neighbourhood of the sea or saline influence. Among the many species, common orach is found on the seacoasts of Europe, Asia, and Africa, extending to the Arctic regions, besides being very common inland as a weed of cultivation. It is abundant in Britain.

Oracle, a response given by a pagan deity or some person speaking in his name to a question relating to a matter of private welfare or public importance. In classical Greece, and to a less extent in Rome, belief in and the consultation of Oracles, which were usually connected with specially famous shrines, was particularly widespread. The Oracle of Apollo at Delphi, reputed to have existed long before the year 1000 B.C. was the most famous, its closest competitor being that of Zeus at Dodona. The responses given by oracles were frequently so framed as to bear interpretation in either of two contradictory senses, e.g. Croesus was told that if he crossed the Halys with his army he would destroy an empire. He did, but it was his own.

Oran, Algerian port c. 250 m W. of Algiers, capital of the department of the same name, an important French military centre and naval station. Since the occupation by the French in 1831 the harbour has been modernised, and a brisk trade is carried on in skins, cereals, vegetables, wine, and wool. Pop. 150,300.

Orange: (1) French town in the Vaucluse department, c. 60 m N.N.W. of Marseilles. It has miscellaneous manufactures, including boots and shoes, beet-sugar, textiles, etc., and has a trade in agricultural produce. It is famous for Roman ruins, which include a triumphal arch, theatre, and remains of the hippodrome. At one time the town was in the hands of the Saracens. It subsequently passed to the house of Nassau, to which William the Silent and William III belonged. Pop. 10,800.

(2) Town in New South Wales, Australia. An important resort for convalescents, owing to its bracing climate. There are valuable gold, silver, and copper mines in the neighbourhood. Pop. 8000.

Orange, the fruit of *Citrus aurantium*, a low-branching evergreen tree of the family Rutaceæ, 30 ft. high, with oval leaves and white fragrant flowers and a large spherical 8-12-celled fruit, which is gold or red when ripe and contains a sweet and juicy pulp consisting of many tiny bladders filled with sap. The fruit is eaten as dessert and is much recommended by doctors for its healthy properties. The fruit of a bitter variety, the Seville or Bigarade Orange, is used for making marmalade. The wood is yellow, hard, and close grained, and takes a high polish.

Orange Free State, province of the Union of S. Africa lying between the Orange and the Vaal R.s., and bounded E. by Basutoland and Natal. The surface consists of a great plateau with a gentle W. slope from the Drakensberg Mountains on the E. border. There are other scattered ridges and elevations. The climate is healthy but hot and dry, and severe

Droughts are sometimes experienced such of the country consists of veldt animals include several species of deer monkeys lynx and there are many kinds of snakes and insects Stock raising is widely practised sheep cattle horses and pigs being bred Agriculture and fruit farming are being steadily encouraged and good crops of wheat vegetables and tobacco are produced mainly around the valley of the R. Caledon There is considerable mineral wealth Diamonds are found near Jagersfontein and both coal and copper are mined Industries are flour milling dairy farming and salt production

For primary educational purposes the province is divided into 61 school board districts Higher education is controlled by the Union Government There are more than 100 schools for Europeans and some 200 non European Both English and Afrikaans are taught as official languages The main religion is that of the various Dutch churches which by far outnumber the Anglican the next largest religious body Bloemfontein is the capital Area 49 600 sq m pop (1931) Europeans only 203 000 c 440 000 natives

Orangeman term for the members of the Orange Society an Irish political association founded in 1793 to support Protestantism in Ireland The régime of the Commonwealth and the large numbers of Puritans and Presbyterians in Ulster had given Protestantism a firm foothold Religious antagonism was especially rife in Co Armagh The Orangemen were wrongly held responsible for violence perpetrated during the suppression of the insurrection of 1798 they were however opposed to the Union of 1801 During the early 19th century their activities were directed against Catholic emancipation which however was granted in 1829 When O Connell tried to get the Union repealed they became loyal to England They call themselves Orangemen after William of Orange (William III) who as the Protestant

champion defeated the Catholic James II at the Battle of the Boyne whose anniversary (July 1) is kept as Orange Day

Orange River in S Africa rising in the Drakensberg Mountains and flowing with various N and S sweeps generally W to the Atlantic passing from E Basutoland along the S border of the Orange Free State across British Bechuanaland and along the S border of SW Africa Among the many tributaries the Vaal which joins the main stream near Douglas is the largest Beyond this the river flows in a wide stream until it reaches the Augrabie Falls (or Hundred Falls) which form a series of cataracts races and falls for c 16 m The mouth is obstructed by a sand bar which only allows the passage of small vessels and even these cannot penetrate more than 40 m upstream The total drainage area is c 400 000 sq m and the length of the river c 1250 m The middle reaches of the river were discovered in 1777 when the name Orange was given in honour of the Prince of Orange by the Anglo-Dutch explorer R J Gordon The further exploration of the river proceeded slowly the falls were discovered in 1813 and the source some 20 years later

Orangutan next to the gorilla is the largest of the anthropoid apes but is less human in structure than either the gorilla or the chimpanzee and is found only in Borneo and Sumatra The orang is almost exclusively arboreal and has its hands and feet adapted for grasping stout branches It feeds on fruit and foliage and makes a platform of twigs to sleep on The coat is reddish brown and long and shaggy to throw off the rain Males are much larger than females and many of them develop when mature great fibrous expansion on the cheeks

Oratory a room or small chapel for devotional purposes attached to a private house or public institution The name is also given to the churches and residences of the Congregation of the Oratory a Roman Catholic com

munity established in Rome in the 16th cent by St Philip Neri (q.v.). The community was introduced into England in the 19th cent by F W Faber and Cardinal Newman, the former setting up a house in King William St., Strand, which eventually developed into the well-known and magnificent Brompton Oratory, while Newman was identified with a similar foundation at Edgbaston, Birmingham, at which his later years were spent and where he died.

Orbit, see SOLAR SYSTEM

Orchard, originally an enclosure for vegetables, but now generally an enclosed plantation of fruit trees (See AGRICULTURE.)

Orchardson, Sir Wm. Quiller (1835-1910), Scotch painter, born and educated in Edinburgh. Orchardson came to London in 1862, where he lived for some time with John Pettie. He became an R.A. in 1877, his first considerable success was with his *Napoleon on Board the Bellerophon*, now in the Tate Gallery. He was knighted in 1907. Orchardson was a successful portrait painter, and gained popularity by his portrayal of scenes from social life.

Orchestra, the portion of a theatre or concert-hall intended for instrumentalists, and the company of musicians themselves, with their instruments. The modern orchestra can be divided into three main sections strings, wind, and percussion. These in turn can be subdivided into (1) first and second violins, violas, violoncellos, and double-basses, (2) wood-wind, consisting of flutes, oboes, *cors anglais*, bassoons or *fagotti*, and clarinets (tenor and bass), brass wind, consisting of horns, trumpet, trombones (tenor, bass, and contrabass), and tubas (tenor, bass, and contrabass), (3) kettledrums, cymbals, triangle, glockenspiel, and bells. To these are added the harp, and occasionally saxophones and pianoforte. More unusual additions called for by composers such as Strauss, Mahler, and Schönberg, include wind-machine and rattle, cowbell and iron chains.

The first instrumental combination comparable to the modern orchestra did not evolve until the 15th cent. The earliest instrumental compositions in existence date from that period and in the libraries of Berlin and Munich are MSS. of 15th-cent contrapuntal dances. The first composer to realise the importance of a preponderance of strings was Monteverde, who incorporated his ideas in the score of his opera *Orfeo*, and thus attained a true tonal balance for the first time. Monteverde established the quartet principle in regard to strings, and Haydn extended his idea to wood-wind and brass, and was the first composer to realise the potentialities of the orchestra as an independent body. Orchestral "colour" (*i.e.* the deliberate grouping and contrasting of different instruments to obtain definite effects) was as yet unthought of. Mozart, Weber, and Schubert all contributed to this advancement. Beethoven was the first composer to write solo passages for individual instruments. The first of the great masters of instrumentation was Hector Berlioz, a daring and brilliant innovator. Tchaikovsky was a masterful colourist, and Wagner, besides being responsible for some of the most wonderful orchestral scores in existence, introduced the "Wagner tuba" for use in the *Ring* cycle, in order to ensure a complete quartet with horn timbre. Many works of Richard Strauss call for a huge and complex orchestra. A less sensational but hardly less brilliant orchestrator is our own Sir Edward Elgar. In both his symphonies he works for a very large combination and with exceptional understanding of instrumental tones.

Another masterly English "colourist," though working with a more subdued palette and on a smaller scale, is Delius, who, notwithstanding a certain monotony of style, has produced effective works for small orchestras.

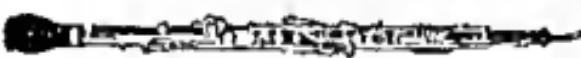
THE INSTRUMENTS OF THE ORCHESTRA *Stringed Instruments* (1) *Violin* This is the predominating in-

trument in the orchestra. If the most beautiful of all sounds is that of a human voice the violin comes nearest to reproducing that sound. Violins are divided into first and second which can be allotted different parts in the music the instruments being identical. (2) Viola A bigger instrument than the violin of a lower pitch and with a richer mellow though much less brilliant and varied tone. The viola has been rather neglected until comparatively recently but in England at least has enjoyed a greater popularity largely owing to the brilliant work of the viola virtuoso Tertis for whom Elgar recently arranged his own cello concerto. (3) Cello or Double Bass Of similar construction to the violin and viola but larger so that it has to be placed between the player's knees. The cello with its rich tone is heard at its best either in chorus in the orchestra or as the solo instrument in a concerto with orchestral accompaniment. With pianoforte accompaniment the balance

is unsatisfactory. Of course when it is played by such a master as Casals the effect is extraordinarily fine. Some of the best parts for orchestral cellists have been written by Elgar the most beautiful being the cello part of his 2nd Symphony. (4) The Double Bass The largest of the string group easily recognisable because its size requires the player to remain in a standing position. The double bass originally had 3 strings but at the beginning of the 19th cent an extra string was added and the instrument is now tuned in fourths.

Wood Wind The wood wind group is much more diversified than the strings. In physical appearance the instruments certainly have a family resemblance but tonally they are more sharply contrasted. (1) Flute The flute is easily recognisable as it is the only instrument of the wood wind group apart from the piccolo which is held horizontally instead of vertically. The flute is one of the most beautiful of this group of instruments.

WOOD WIND INSTRUMENTS



piccolo

cor anglais



oboe



clarinet



bassoon

and can be invaluable in "atmospheric" music, such as that of Debussy. The *piccolo* is a smaller and shriller edition of the flute, playing in a higher register. (2) *Oboe*. The oboe, with its sweet and penetrating soprano tone, is perhaps the most individual wood-wind instrument. It is most effective as a solo instrument, playing long curving phrases. Technically the oboe is restricted more to *cantabile* passages than, say, the flute, as it is unsuitable for "double tonguing," the means by which the flautist copes with quick passages. (3) *English Horn* (*Cor anglais*). This instrument bears no resemblance to a horn, being a straight instrument, longer than the oboe, having a curved mouthpiece tube and a pear-shaped end or bell. Its compass is much the same as that of the oboe, but it is pitched a fifth lower.

(4) *Clarinet*. This instrument has become one of the mainstays of the orchestra, mainly owing to the fact that its power is capable of more varied gradations, it has a good range and can play quick passages. The tone of the clarinet approximates closer to the human voice than its fellows. Its tone has a milder quality and it is more suited to contemplative passages than either the oboe or flute.

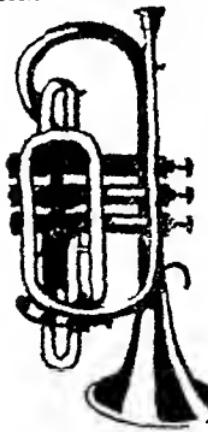
(5) *Bassoon*. The bassoon might also be called the busoon, for it is in that guise that it has so often been made to appear. It features inevitably in grotesque passages, but it is also valuable for the body that its tone lends to the rest of the wood-wind group.

Brass (1) *French Horn*. Undoubtedly the most beautiful instrument of the brass-

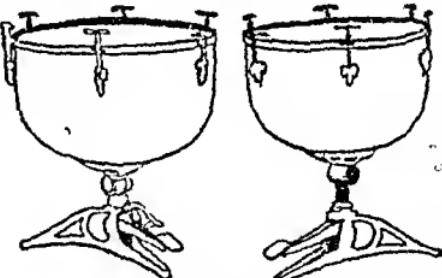
wind section. It is easily recognisable, being a curved brass tube in the

conventional horn shape. The horn has a great range, throughout which it never loses the mellow beauty of its tone. (2) *Trumpet*. The trumpet will also give no trouble to the concert-goer wishing to identify the instruments. It is straight and well-proportioned, its bright and piercing tone is unmistakable and it is usually to be heard in the more agitated and dramatic passages. (3) *Trombone*. The rectangularly shaped doubled-in tube which is familiar in music-halls as well as concert-halls. Despite the rather degrading uses to which it has been put in its time, it remains a noble instrument, and is, moreover, more efficient than other wind instruments in that it has absolute control over pitch, and can by means of its *slide* (the inner tube slides backwards and forwards within the outer one) produce every sound in the diatonic and chromatic scales within its compass. (3) *Tuba*. The tuba is the largest instrument in the orchestra. Wagner and Tchaikovsky made effective use of this powerful instrument, which can give immense weight to the brass choir.

Percussion. The percussion section of the orchestra consists usually of 3 kettle-drums, resembling copper or brass bowls and covered with parch-



Cornet—a brass instrument



Tympani, or kettle drums

ment, the tension of which is regulated by screws fixed to the rim, allowing

the drums to be tuned to the notes required. Other members of this group are the *bass drum* (the familiar big drum) and the *side drum* which is the smallest. To these are added the triangle, cymbal and where necessary the tambourine and castanets.

The general lay-out of an orchestra differs according to the idiosyncrasies of the conductor or the acoustical peculiarities of the hall. These differences do not amount to much in practice however and the usual plan of an orchestra is as follows. The 1st violins are at the front of the platform on the audience's left hand and the 2nd violins on its right. The cellos, wood wind and violas form a rough semi-circle from left to right of which the conductor is the centre while the double basses stand at the extreme left behind the 1st violins and cellos with the harp or harps opposite them at the extreme right. The brass is usually behind the wood wind and the percussion behind the brass, the farthest away from the conductor and directly facing him.

Orchids flowering plants of the family Orchidaceæ are divisible into two classes the *Epiphytes* or those

growing on trees and *Terratorial* or ground orchids. All the British wild species are territorial but many tropical ones are epiphytic in dense forests where no light reaches

the ground. A few of the British orchids are saprophytic that is they have no chlorophyll and therefore can make food for themselves but obtain it from dead organic matter in the soil. The Bird's nest orchis is a brownish saprophyte not uncommon in woods in June. Others are parasitic on the

roots of grasses or other plants. Most orchids require the association of a particular fungus with which they exchange one kind of food for another.

The flowers are so variable in form as to defy general description yet so peculiar that very slight experience is needed to refer them to their proper family. The structure of the lower lip of the corolla is in many cases most singular sometimes resembling in form size and colour insects which naturally frequent the places where the flowers grow such as the bee fly and spider orchis.

Great attention has been paid of late years to the cultivation of exotic orchids and in a well managed orchid house one or other may be seen in bloom at all seasons of the year some clinging to broken potsherds some to logs of wood some to coconut fibre or simply suspended by wires from the roof of the house.

Ordeal method of trial used in most primitive communities involving a direct appeal to the supernatural to the judgment of God. In England 4 forms were used in criminal cases (1) hot iron the accused was required to carry a hot iron for 9 steps. His hand was then sealed up and examined on the third day. If it had blistered he was guilty (2) hot water the procedure was similar to that of the hot iron ordeal (3) cold water the accused was thrown into water if he sank he was innocent if he floated guilty (4) the morsel the accused had to swallow a piece of bread if it stuck in his throat he was guilty. Trial by battle does not seem to have been used. Trial by Ordeal was prohibited by the Council of the Lateran in 1215 and was abolished in England by an Order in Council of Henry III in 1219.

Order (architecture) specific mode or style of building and design in Greek and Roman architecture (q.v.) The three Greek orders are Doric Ionic and Corinthian. The Romans took over and modified the three Greek orders and introduced two new ones—



Diagram of Orchidaceæ

ORCHIDS



the Tuscan a modified Doric and the Composite a blend of Ionic and Corinthian. The greatest master pieces of classical Greek architecture e.g. the Parthenon employ the Doric order. Ionic is seen in the Erechtheum and in interior colonnades of some Doric temples. The best example of Greek Corinthian is the Choragic Monument of Lysicrates in Athens the first, second and third ranges of the Colosseum in Rome exemplify the Doric, Ionic and Corinthian orders respectively. The Corinthian order appealed strongly to the Romans and much of the Roman work in Greece e.g. the Temple of Olympian Zeus in Athens as well as the bulk of the monuments in Rome itself is in this style. See ARCHITECTURE. CORINTHIAN ORDER, IONIC ORDER, DORIC ORDER.

Ordericus Vitalis (1073-1142) English chronicler was a monk at St Evroul in Normandy. In his work the *Historia ecclesiastica* the parts dealing with the period 1107-11 are very valuable as one of the few sources of the information they contain.

Order in Council, an order made by the sovereign by and with the advice of His Majesty's Privy Council. The King, by virtue of his prerogative can thus legislate for conquered or ceded territories etc. or make war or statutes for the United Kingdom. See also PARLIAMENT.

Orders of Knighthood, see KNIGHTHOOD.

Ordnance Board, an obsolescent department concerned with the management of forts, armaments, garrisons and stores. It took its name from a State "ordnance" referring to gun barrels but was reorganised as a civil department by Charles II in 1663 being answerable to the Lord Treasurer and the Lord High Admiral. In 1690 it was divided into military and civil departments. The Board was transferred to the War Office by Act of last resort in 1855.

Ordnance Survey see MAP, DESCRIPTION.

Ordovician System, term for the beds of the Lower Palaeozoic era which lie between the Cambrian and Silurian systems (q.v.). The name is derived from the Ordovices an ancient Welsh tribe who inhabited the district where these beds are well exposed and was given to the system by Lapworth (q.v.). Its recognitions include the famous Warkworth Sedgwick carbonaceous shale (q.v.). In Britain the lower limit of the system often grades into the Cambrian and is difficult to define.

As might be expected the Ordovician fossils are more numerous and varied than their Cambrian predecessors, the most important being the trilobites which were at the peak of their evolution and are used for coring and correlating the shaly deposits, the graptolites which are extremely valuable in naming the deep-water shales and the brachiopods. The ancestors of the ammonites and nautiloids arose at this time but conchoidea and lamellibranchs were not important. The ancestors of the modern starfishes and sea urchins arose during the Ordovician.

The Shropshire Ordovician includes veins of zinc lead and barytes and supplies a quartz which can be crushed into sand for glass manufacture or used as road metal. The Lake District also furnishes road metal and Wales ironing stones. The reservoirs for the water supply of Liverpool and Manchester are situated in Ordovician rock. Abroad iron ore is found in the Ordovician of France, lead zinc and manganese oil and gas in the United States and gold in Tasmania and New Zealand.

Ore term for a mass of mineral rock containing one or more metals in metallic nature and an oxidized belt extractable profitably. See ORE DEPOSITS.

Ore-dressing is the process by which minerals are purified prior to smelting. The treatment may consist in taking advantage of the difference between the mineral and rocks in respect of some physical property

COMPARATIVE TABLE OF BRITISH ORDOVICIAN ROCKS

	S. Wales	Spaldon	Shropshire	Lake District	Wales (Dolomites)	Green (Charnian)
Stephanian	Shale Beds Red Hill Beds Shoalshank Limestone		Upper Chibury Series	Asl " Shales Sourcepates Limestone	Upper Hartshill Shales	Upper Pennant Beds
Cambrian	Robeston Wathen Limestone Myndrum Shales	Spaldon Volcanic Series	Lower Chibury Series	Coniston Limestone Series	Lower Hartshill Shales	Low & Drummond's Shallow Fairstones Whitehouse series Anlwell series Balaclachin Series
Llandeiloan	Myndrum Limestone Hendre Shales Llandeilo Limestone	Gwastadnant Grits Glanrafon Shales	Middleton Series	Broadford Volcanic Series	Glenkin Series	Barr Series
Llanvirnian	Llanvirn Ashes	Mesgwyn Shales	Supplementary Ashes Upper Hope Shales	Millburn Beds Ellerhill Beds	Radiolarian Cherts and Tuffs	Radiofarian Cherts and Tuffs
Skiddawian	Skiddaw Volcanic Series	Plas-y-nant Beds	Lower Hope Shales Menton Flags Stiper Quartzite			Black Shales Ballintreas Volcanic Rock

such as specific gravity, magnetic permeability, and surface tension between

the surface of a mineral and water containing various constituents. In addition, the coefficient of friction, the electrical conductivity, the dielectric constant, and the colour have been made use of to a limited extent.

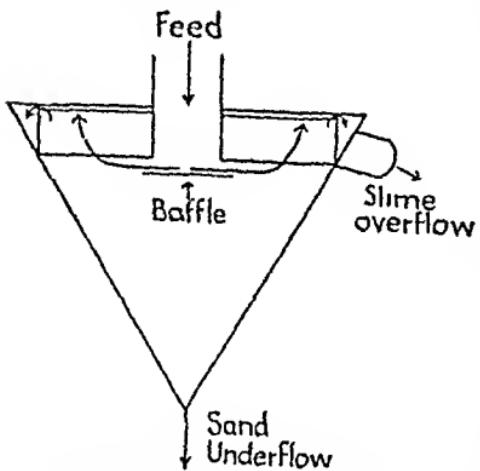


Diagram of a simple 'Jig' which separates coarse material by a rapid up and down motion through water

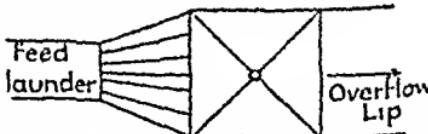
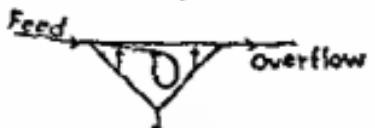


Diagram of the Spülkasten, an inverted cone separating materials by water concentration, seen from above

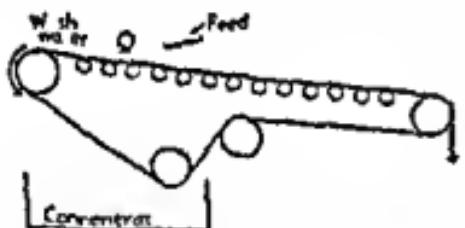
Gravity separation is by far the most important method, for most valuable minerals are of considerably higher specific gravity than the usual gangue (valueless) minerals. In the laboratory it is possible to use what are called specific gravity liquids to separate minerals, these are liquids having a higher specific gravity than one.

the minerals and a lower specific gravity than the other when a mixture of the two is brought into such a liquid the light constituents float and the heavy constituents sink.



Simplified Vertical Section of the Cone Classifier

Concentration by flotation one of the most economically important inventions of modern times depends upon entirely different principles. It originated in an observation made in 1860 by a Welshman Haines who found that when a mineral ore is brought into contact with oil the sulphides of metals become wetted with oil and repel water. Elmore in 1898 separated sulphide minerals by bringing the watery pulp in contact with a large bulk of oil into which the mineral



Simplified Diagram of the Flotation process for separation of fine mineral particles.

particles went whereas the gangue stayed in the water.

Magnetic separation early attracted inventors but it was not realised until about 1895 that it could be applied to feebly magnetic minerals. A great variety of types of magnetic separator are in use.

Electrostatic separation depends upon the force exerted upon a particle by the electric field (see ELECTRICITY). Electrically conducting particles are instantaneously charged by contact with the electrode and then strongly repelled by it whereas non-conducting particles are not repelled and fall vertically away from it. The process is only successful when the material

is perfectly dry and this is a condition difficult to obtain in a damp climate. The Hatfield process of dielectric preparation makes use of the attraction exerted by an electric field upon a particle which is not charged.

CONSULT S J Truscott *A Text book of Ore Dressing* (London 1933).

Oregon, NW State of the US & bounded W by the Pacific E by Idaho N by Washington and S by California and Nevada. The surface along the coast is low and sandy rising fairly rapidly to the low N to S Coast Range which is separated from the much higher parallel Cascade Range by the valleys of the Willamette and other rivers E of the Cascade. The State consists of high and usually arid table-lands with a general slope upwards towards the Rocky Mountains. The main products of Oregon are cereals fruit timber and fish. The wheat harvest provides upwards of 40 million bushels annually and there is about half that quantity of oats. Sheep and cattle are extensively raised. Fruit production especially apples is of importance and the forests are most extensive and have resulted in the establishment of great lumbering paper and furniture industries. The salmon fisheries provide for a huge canning industry. Other industries include meat packing and flour milling.

The chief towns are Salem the capital and Portland. Educational institutions are at Eugene (the State university) Portland and Corvallis the seat of a celebrated agricultural college. Area 95 800 sq m pop (1939) 953 800.

Orel (Орел) Russian province immediately N of Voronezh and Kursk. The surface is a large plain forming a part of the Black Earth area watered by the Rrs Oka and Sosna and their tributaries. Agriculture is widely carried on and crops of cereals hemp and vegetables are raised. Live stock is reared though horse breeding for which the province was formerly noted has fallen off. There are manufactures in the larger

COMPARATIVE TABLE OF BRITISH ORDOVIAN ROCKS

	S Wales	Snowdon	Shropshire	Lake District	Moffat (Deep water)	Girvan (Shallow sea)
Asaphian	Slade Beds Red Hill Beds Shorlshook Limestone		Upper Chir bury Series	Ashgill Shales Staurocephalus Limestone	Upper Hart- fell Shales	Upper Drift muck Beds
Caradocian	Robeston Wathen Limestone Mydrum Shales	Snowdon Volcanic Series	Lower Chirbury Series	Coniston Limestone Series	Lower Hartfell Shales	Lower Drummer Beds Shallock stones Whithouse Ardwell series, Balclatchie series
Llandaffian	Mydrum Lime- stone Hendre Shales Llandeilo Limestone	Gwastadnant Grits Glanrafon Slates	Middleton Series	Borrowdale Volcanic Series	Glenkulin Series	Barr Series
Llanvirnian	Llanvirn Ashes	Maesgwm Slates	Stapeley Ashes Upper Shales	Millburn Beds Ellergill Beds	Radiolarian Cherts and Tuffs	Radiolarian Cherts and Tuffs
Silurian	Skomer Vol- canic Series	Plas-y nant Beds	Lower Hope Shales Myton Flags Stiper Quartzite			Black Shales Ballantrae Volcanic Ro-

such as specific gravity, magnetic permeability, and surface tension between

the surface of a mineral and water containing various constituents addition, the coefficient of friction, electrical conductivity, the dielectric constant, and the colour have been made use of to a limited extent

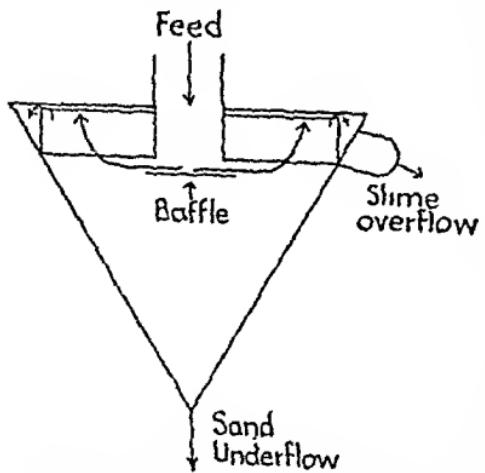


Diagram of a simple "Jig" which separates coarse material by a rapid up and-down motion through water

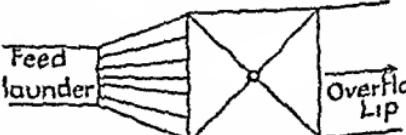
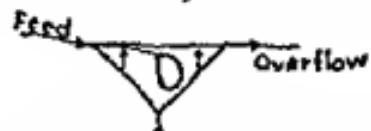


Diagram of the Spitzkasten, an inverted cone separating materials by water concentration, from above

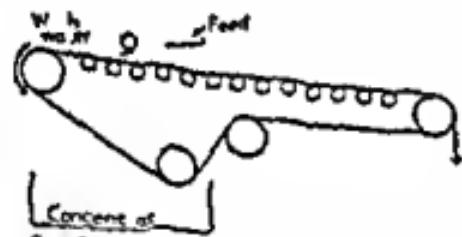
Gravity separation is by far the most important method, for valuable minerals are of considerably higher specific gravity than the gangue (valueless) minerals. In laboratory it is possible to use what is called specific gravity liquids to separate minerals, these are liquids of a higher specific gravity than on

the minerals and a lower specific gravity than the other when a mixture of the two is brought into such a liquid the light constituents float and the heavy constituents sink.



Simplified Vertical Section of the Core Class Flotation Machine

Concentration by flotation one of the most economically important inventions of modern times depends upon entirely different principles. It originated in an observation made in 1860 by a Welshman Haynes who found that when mineral ore is brought into contact with oil the sulphides of metals become wetted with oil and repel water. Elmore in 1898 separated sulphide minerals by bringing the rotary pulp in contact with a large bulk of oil into which the mineral



Simplified Diagram of the Flotation Machine for separation of fine material.

particles went whereas the gangue stayed in the water.

Magnetic separation early attracted inventors but it was not realised until about 1895 that it could be applied to feebly magnetic minerals. A great variety of types of magnetic separator are in use.

Electrostatic separation depends upon the force exerted upon a particle by the electric field (see ELECTRICITY). Electrically conducting particles are instantaneously charged by contact with the electrode and then strongly repelled by it whereas non-conducting particles are not repelled and fall vertically away from it. The process is only successful when the material

is perfectly dry and this is a condition difficult to obtain in a damp climate. The Hatfield process of *dielectric preparation* makes use of the attraction exerted by an electric field upon a particle which is not charged.

CONSULT S J Truscott *A Text book of Ore Dressing* (London 1893).

Oregon N W State of the U.S.A bounded W by the Pacific L by Idaho N by Washington and S by California and Nevada. The surface along the coast is low and sandy rising fairly rapidly to the low N to the Coast Range which is separated from the much higher parallel Cascade Range by the valleys of the Willamette and other rivers E of the Cascades the State consists of high and usually arid table lands with a general slope upwards towards the Rocky Mountains. The main products of Oregon are cereals fruit timber and fish. The wheat harvest provides upwards of 70 million bushels annually and there is about half that quantity of oats. Sheep and cattle are extensively raised. Fruit production especially apples is of importance and the forests are most extensive and have resulted in the establishment of great lumbering paper and furniture industries. The salmon fisheries provide for a huge canning industry. Other industries include meat packing and flour milling.

The chief towns are Salem the capital and Portland. Educational institutions are at Eugene (the State university) Portland and Corvallis the seat of a celebrated agricultural college. Area 95 600 sq m pop (1930) 953 800.

Orel (Орел) Russian province immediately N of Voronezh and Kursk. The surface is a large plain forming a part of the Black Earth area watered by the Rs. Oka and Sosna and their tributaries. Agriculture is widely carried on and crops of cereals hemp and vegetables are raised. Live stock is reared though horse breeding for which the province was formerly noted has fallen off. There are manufactures in the larger

COMPARATIVE TABLE OF BRITISH OXYGENIC ROCKS

	S. Wales	Snowdon	Shropshire	Lake District	Morristown (New Jersey)	Green Sandstone
Stratification	Slade Beds Red Hill Beds Shoalshock Limestone		Upper Cliffton butte Series	Ash Hill Shales Cutoxbridge Limestone	Upper Hart- side Shales	Upper Drift Beds Shallow deposits Whitethorn Grits Ardwel Grits Llanfachreth Series
Correlation	Roberton Wathen Limestone Myddfai Shales	Snowdon Volcanic Series	Lower Chirkbury Series	Cwmystwyth Limestone Series	Lower Barffell Shales	Lower Drift Beds Shallow deposits Whitethorn Grits Ardwel Grits Llanfachreth Series
Lamination	Myddfai Lime stone Hendre Shales Llanddewi Limestone	Gwastadnant Grits Glanrafon Slates	Midletton Series	Borrowdale Volcanic Series	Glenkluas Series	Barrandian Series
Lamination	Llanvihin Ashes	Mae-gwyn Slates	Stepoley Ashes Upper Hope Shales	Millburn Beds	Radiolarian Cherts and Tuffs	Radiolarian Cherts and Tuffs
Sedimentation	Skomer Vol canic Series	Plas-y-nant Beds	Lower Hope Shale Myton Flags Upper Quartzite	Illergill Beds		Black Shales Ballantrae Volcanic Rock

such as specific gravity, magnetic permeability, and surface tension between

the surface of a mineral and water containing various constituents, addition the coefficient of friction, electrical conductivity, the dielectric constant, and the colour have been made use of to a limited extent

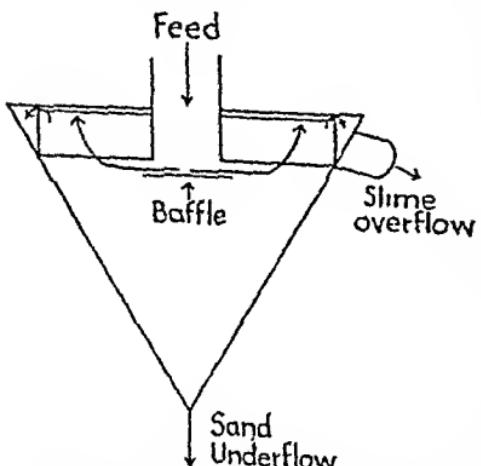


Diagram of a simple "Jig" which separates coarse material by a rapid up and down motion through water

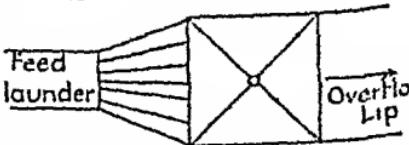
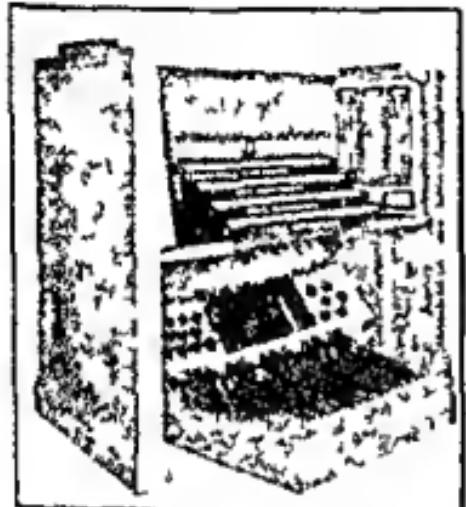


Diagram of the Spitzkasten, an inverted cone separating materials by water concentration from above

Gravity separation is by far the most important method, for most valuable minerals are of considerably higher specific gravity than the gangue (valueless) minerals. In laboratory it is possible to use what is called *specific gravity liquids* to separate minerals, these are liquids of a higher specific gravity than one

accumulate and deliver air at constant pressure was put into connection with the pipes by valves opened by the pressure of the player's fingers upon the keys. The next step was to open these valves by means of power derived from the air pressure of the wind-chest, the key then operating only a small valve controlling this power. The final step was to make use of electromagnets operated by contacts attached to the keys. These then regulate the supply of air to the pipes and the console that is the whole set of manuals



The Console of the Org. & B. Co. Ltd. & H. use
London

pedal key board and stops can be connected to the organ by means of a cable.

The Wurlitzer organ used in cinemas to-day is a musically illegitimate offspring of the organ proper. It is capable of all sorts of effects actuated by ingenious devices.

Organic Chemistry is the chemistry of the compounds of carbon although it is convenient to discuss a few carbon compounds such as the oxides of carbon, the carbides and the carbonates under inorganic chemistry. The term organic chemistry arose from the study of materials found in the living organism, either animal or vegetable and until about a century

ago it was considered that these substances required a vital force for their production. The death blow to the vital force theory was dealt by Wöhler in 1828 by his synthesis of urea ($\text{NH}_2\text{CO}\text{NH}_2$) a typical organic product of animal origin from ammonium cyanate a material produced from exclusively mineral sources.

Since the day of Wöhler a very large number of naturally occurring organic compounds have been prepared synthetically in the laboratory.

One of the characteristics of organic chemistry is that several substances may be represented by the same empirical formula that is that there exist a very large number of isomerides (see article ISOMERISM). For instance even a simple formula like $\text{C}_2\text{H}_6\text{O}$ stands for two entirely different substances namely ethyl alcohol and dimethyl ether. In inorganic chemistry isomerism is a rare occurrence.

One of the great steps forward in the theory of the constitution of organic compounds and one which gave great assistance to the practical side of the science was the theory of complex radicals which was put forward by Liebig and Wöhler in 1831 as a result of their researches on benzoic acid and its derivatives. They showed that whole groups of atoms passed through many chemical reactions unchanged and appeared as stable structures. Examples are $-\text{CH}_3$, $-\text{COOH}$, $-\text{CHO}$, etc.

Classification of Organic Compounds

The main divisions into which organic compounds are to be classified are the aliphatic and the aromatic. The names arise from the fact that the fats belong to the first group whilst the first members of the second group that were subjected to investigation possessed a strong and not unpleasant odour. The aliphatic compounds consist of substances in which the constituent atoms are arranged in the form of open chains which may or may not have branched chains attached to them but which do not form a ring.

The aromatic compounds are those

towns (Orel and Eletz) of chemicals, iron goods, flour-milling and leather. Peasant industries include rope, carpets, lace, etc. Area, 13,300 sq m. pop (1926) 1,884,000 (2) Capital of above, 98 m SW of Tula, rapidly becoming an important educational centre for the whole province, since the establishment of a university in 1919. Principal industries are flour-milling and the manufacture of rope, candles, and cigarettes. Pop 77,000.

Orenburg (1) Russian province S of the Kirghiz Republic. The surface is hilly, and is watered by the Ural, Or, and Samara. Parts are fertile, and fairly good crops of cereals are raised and live stock kept. There are deposits of coal and salt. A notable peasant industry is the knitting of goats'-wool shawls. Area, 25,400 sq m., pop (1926) 674,000 (2) Capital of above, on the Ural R and the Tashkent Railway. It is a large agricultural market and produces articles for the domestic use of the peasants—candles, soap, oil, rope, leather, etc. Pop 129,100.

Orfe, see CHUR

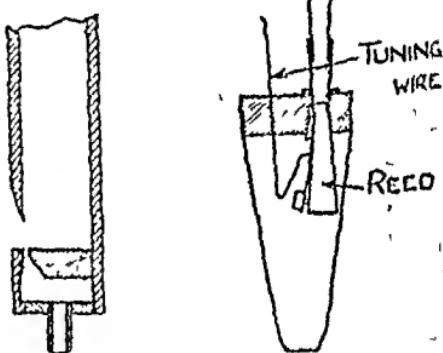
Organ The organ is a musical instrument operated through a key-board or "manual," by means of which air under pressure can be supplied at will to pipes which emit the required note. The organ produces musical sounds by means of pipes of two fundamentally different kinds, these correspond to the flute, tin whistle, or Pan pipes, and to the clarinet, mouth-organ, or concertina. In the first class of pipe, which are called *flue-pipes*, the air in a hollow tube is set into vibration by a jet of air blown against a solid edge. The note of such a pipe is determined by its length, and by whether it is open or closed at the end opposite to where it is blown.

The second class of pipe used is the *reed pipe*, in which the note emitted depends primarily upon the natural period of vibration of a metal reed set in motion by the current of air.

A full-sized organ is provided with

a large number of sets of pipes, most of which cover the whole range of the key-board, furthermore, it is provided with a number of key-boards or *manuals* up to five. The various sets of pipes are brought into connection with the key-board by means of stops usually in the form of knobs distributed on either side of the key-board, these are pulled out when it is required to bring a certain set of pipes into action. In addition to the key-boards operated by the hands, there is also a pedal key-board played by the feet, this is chiefly used to produce the deepest notes.

The various manuals are associated



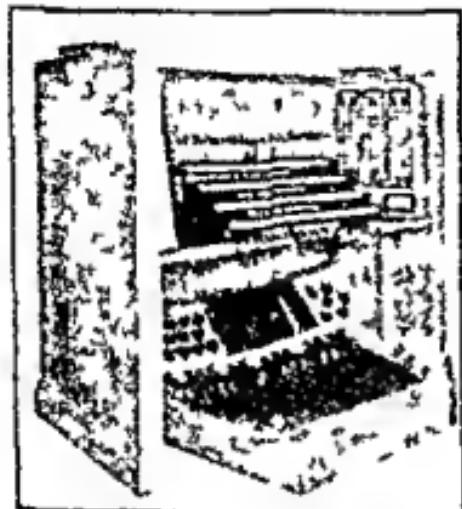
FLUE-PIPE

REED PIPE

Section of Flue and Reed Pipe with the chief parts into which the organ is divided. These are the *echo organ*, the *solo organ*, the *swell organ*, the *great organ*, and the *choir organ*, this being the order of the manuals from top to bottom, to these we must of course add the *pedal organ*. Each of these organs has its own set of stops and *couplers* are provided by which the manuals and the pedal organ can be coupled together in any desired arrangement, so that when one is played, the others play also.

The mechanism of the organ has undergone great changes in recent years. In the earliest organs the *wind chest*, which consisted of a bellows worked by hand and forcing air into another bellows, weighted so as to

accumulate and deliver air at constant pressure was put into connection with the pipes by valves opened by the pressure of the player's fingers upon the keys. The next step was to open these valves by means of power derived from the air pressure of the wind-chest the key then operating only a small valve controlling this power. The final step was to make use of electromagnets operated by contacts attached to the keys. These then regulate the supply of air to the pipes and the console that is the whole set of manuals



The Console of the Organ Brodung M. use
Lo d

pedal key board and stops can be connected to the organ by means of a cable.

The Wurlitzer organ used in cinemas to-day is a musically illegitimate offspring of the organ proper. It is capable of all sorts of effects actuated by ingenious devices.

Organic Chemistry is the chemistry of the compounds of carbon although it is convenient to discuss a few carbon compounds such as the oxides of carbon the carbides and the carbonates under inorganic chemistry. The term organic chemistry arose from the study of materials found in the living organism either animal or vegetable and until about a century

ago it was considered that these substances required a vital force for their production. The death blow to the vital force theory was dealt by Wöhler in 1828 by his synthesis of urea ($\text{CO(NH}_2\text{)}_2$) a typical organic product of animal origin from ammonium cyanate a material produced from exclusively mineral sources.

Since the day of Wöhler a very large number of naturally occurring organic compounds have been prepared synthetically in the laboratory.

One of the characteristics of organic chemistry is that several substances may be represented by the same empirical formula that is that there exist a very large number of isomers (see article Isomerism). For instance even a simple formula like $\text{C}_2\text{H}_6\text{O}$ stands for two entirely different substances namely ethyl alcohol and dimethyl ether. In inorganic chemistry isomerism is a rare occurrence.

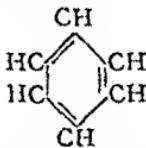
One of the great steps forward in the theory of the constitution of organic compounds and one which gave great assistance to the practical side of the science was the theory of complex radicals which was put forward by Liebig and Wöhler in 1833 as a result of their researches on benzoic acid and its derivatives. They showed that whole groups of atoms passed through many chemical reactions unchanged and appeared as stable structures. Examples are — CH_3 — COOH — CHO etc.

Classification of Organic Compounds

The main divisions into which organic compounds are to be classified are the aliphatic and the aromatic. The names arise from the fact that the fats belong to the first group whilst the first members of the second group that were subjected to investigation possessed a strong and not unpleasant odour. The aliphatic compounds consist of substances in which the constituent atoms are arranged in the form of open chains which may or may not have branched chains attached to them but which do not form a ring.

The aromatic compounds are those

whose structure is represented by closed chains, or rings, of atoms, and they may further be subdivided into two classes (a) the carbocyclic or homocyclic compounds, in which the ring is composed solely of carbon atoms (although other elements may be attached to these atoms), and (b) heterocyclic compounds, in which the ring is composed both of carbon atoms and of an atom of another element such as nitrogen or sulphur. The majority of carbocyclic compounds are derived from the hydrocarbon benzene C_6H_6 and of the structure



The benzene derivatives form one of the most important groups of organic compounds, both from the theoretical and industrial points of view.

The heterocyclic compounds are of somewhat lesser industrial importance than the aromatic homocyclic derivatives, but they are of considerable scientific interest, as the degradation products of numerous organic substances of vegetable origin, including the alkaloids, belong to this group.

Present-day tendency in organic chemistry is to draw the science ever nearer to biochemistry. More and more of the physiological functions of the living body are being explained chemically, and it is evident that sooner or later the structure of all the hormones will have been elucidated, and their synthesis accomplished, success in this respect having already been achieved in the ease of some of those having not unduly complex structures.

A chemical problem which has attracted attention for many years, but which is not as yet solved, is that of the synthesis of a large number of very complicated materials by plants which have as their raw materials only carbon dioxide and water. This question may be said to be the basis of

organic chemistry, since all the complex organic substances which are found in nature are ultimately derived from plants.

The Examination of Organic Compounds The analysis of organic compounds and investigation of an organic substance differs considerably from the procedure that is followed in the case of an inorganic material. In the case of organic compounds, the elements present are, as a rule, strictly limited, and in addition to carbon, which must necessarily be present, there are seldom more than three or four other elements, and these may easily be detected by simple tests.

Consult J. B. Cohen, *Theoretical Organic Chemistry* (1925), J. Schmidt, *Organic Chemistry* (1932).

Organo-Metallic Compounds are compounds in which one or more organic radicals are attached directly to a metal via the carbon atom. Thus, compounds such as the sodium salts of organic acids are not classed as organo-metallic compounds, since the sodium is attached only indirectly to the carbon atom through oxygen. Organo-metallic compounds are purely synthetic products, and do not occur in nature, but whilst many of them are only of theoretical interest, some are of practical value either as reagents in the chemical laboratory or as therapeutic media, and others have properties which enable them to be utilised in industry. Members of the aliphatic series are usually prepared by the action of the metal on the corresponding alkyl iodide. Numerous organo-metallic compounds find a use in medicine (see ANTISEPTICS and CHEMOTHERAPY). The more important organo-metallic compounds of therapeutic value contain, amongst others, the following metals and metalloids arsenic, antimony, mercury, silver, bismuth, and gold.

Oribi, the name for a few species of small fawn-coloured African antelopes. The bucks are about 2 ft high and have short spike-like horns.

Oriel Window, a bay window pro-

jecting from the face of a building usually from an upper storey sometimes supported by pillars or corbels. There are some good examples in the Oxford Colleges.

Origen (c. 185 c. 253) Christian theologian was born in Egypt of Christian parents his father Leonidas educating the boy himself. When Origen was 15 years old he attended the lectures of Pantænus and Clement in Alexandria and signs of his grasp of Greek philosophy and the Scriptures were soon apparent. His thirst for knowledge led him to devote much of his time to the interpretation of the Scriptures whilst he also studied Hebrew and the works of Plato and other philosophers.

His literary work now began and he wrote and instructed in his native Alexandria until c. 31 when jealousy on the part of Demetrios caused Origen to settle at Caesarea where he not only preached but established a school which flourished rapidly. His work in reconciling secular knowledge with Christianity makes him one of the most learned and distinguished theologians of the primitive church.

Amongst Origen's most important works may be mentioned his commentaries and the *Hexapla* an edition of the Scriptures in six languages.

Originating Summons see PRACTICE AND PROCEDURE

Orinoco great river in the N of S America. Rising in the Sierra Parima a range in the S of Venezuela it flows N along the Columbian border and then turns E in which direction it flows to the Atlantic. Some 160 m from its source the river divides part flowing S to reach the Amazon system via the Cauca Canal and the Rio Negro. The main affluents are the Ventuari, Guaviare, Aracá, Meta, Apure and Caroni. The delta begins more than 100 m from the river's mouth and occupies a swampy area of c. 90 sq m. The navigable length is as far as the confluence of the Apure above which rapids and falls impede the passage of vessels. The total

length is 1600 m and the total area watered c. 380 000 sq m.

Oriole, better known as the Golden Oriole is a handsome bird the cock being yellow and black and rather larger than a starling. It occasionally visits England in the spring. They feed on fruits and the hen which is greenish yellow makes her nest in trees.

Orion [o'reen] in classical mythology a giant son of Poseidon (Neptune). He was slain in error by Artemis (Diana) and after his death was raised to heaven to form the constellation that bears his name. See CONSTELLATION.

Orkney Islands group of 9 islets off the N coast of Scotland of which they form a county. 29 are inhabited. They are separated from the mainland by the 6 m wide Pentland Firth. For the most part they are bleak and fairly low lying the highest points not reaching more than c. 800 ft. The inhabited islands possess a few short rivers and small lakes. Agriculture comprising crops of oats, barley and vegetables is successfully carried on as the soil is fertile in many places and the presence of the Gulf Stream prevents extreme cold. Live stock especially a breed of small vigorous horses are raised. With the exception of sandstone there are no minerals. The leading industry is fishing and brewing and small cottage industries are also carried on.

The most populous islands are Pomona (or Mainland), S. Ronaldshay, Hoy, Westray, Sanday and Shapunshay. Area 3.6 sq m. pop. (1931) 2,000. Capital Kirkwall.

Orléans important French town on the Loire capital of the Loiret department. Industries include machinery, textiles and agricultural implements and there is a considerable trade in wool, dairy produce, wine and live stock. Orléans will always be closely associated with Joan of Arc who raised the English siege in 1429. Her house and statues are objects of public interest. Pop. 71,600.

Orléans, Charles, Duke of (1391-1465), known as Charles d' Orleans, Fr poet, was taken prisoner at the battle of Agincourt and imprisoned in England. His verse, which is in the mediaeval style and forms, contains some charming rondels.

Orléans, Siege of (Hundred Years' War). The siege of this town, held by a French garrison under Dunois, the Bastard of Orléans, was commenced Oct 12, 1428, by the Earl of Salisbury, succeeded on the 26th by the Earl of Suffolk. The siege dragged on till April 1429, on April 29 Joan of Arc entered the town, on May 3 the French assumed the offensive, and on May 7 the siege was raised, and Suffolk withdrew.

Orlov, see OREL.

Orm or Ormin, an English monk of the 12th and 13th cents., author of the *Ormulum*, commentaries in verse on the gospels, written in Middle English. The book is called after him—

This boke is nemed Ormulum

Forthi that Orm it wrohte —

and is valuable for the light it throws on the development of the Midland dialect, and for its peculiar system of phonetic spelling. The verse is unrhymed and non-alliterative.

Ormolu, an alloy of brass used in making candlesticks, small statues, and other articles, and as the basis of a kind of enamel work in which a carved-out design is filled with a fused mass of mixed enamel and alloy. The resulting enamel is called *émail cloisonné*. The Chinese have long practised the art. The composition of ormolu is generally 58 parts of copper, 26 of zinc, and 16 of tin.

Ormsby-Gore, Rt Hon. William George (b. 1885), English politician. He entered Parliament in 1910, served in the World War in France, and later was Parliamentary Secretary to Lord Milner and Assistant Secretary to the War Cabinet. He became Under-Secretary of State for the Colonies 1922-4, and again in the Conservative Government, 1924-9. With the return of the National Government he was

made Postmaster-General, and later First Commissioner of Works. He is a keen geographer, and was President of the Geographical Section of the British Association in 1926. He represented the British Government at the League of Nations in Sept 1933.

Ormuz, see Hormuz.

Ormuzd, see ZORASTER.

Orne, French department immediately S of Calvados, is on high ground, culminating in the forest of Ecouves (1400 ft.), and forms the watershed for a number of small rivers, of which the Orne waters most of the department. Much of the soil in the E is fertile, while the W is mountainous and forested, good crops of cereals and potatoes are grown, and the ample pasturage supports a flourishing dairy industry, one of whose products is the famous Camembert cheese (q.v.). Pears and cider apples are widely grown, and bee-keeping is of importance. Industries include cotton, iron-founding, and general metal goods, tanning, paper, bleaching, and glass-making. The chief town is Alençon. Area, 2370 sq m., pop. 277,600.

Ornithogalum, see STAR OF BETHLEHEM.

Ornithology, the branch of zoology of which birds are the subject-matter.

Orogeny, see MOUNTAIN BUILDING.

Orpen, Sir William Newenham Montague (1878-1931), Irish painter, born in Co Dublin. Orpen studied in Dublin and later at the Slade School in London, joining the New English Art Club in 1900. His early interiors with portraits a new genre in England at that time, were admired for their quiet and attractive colouring and careful handling. Orpen was appointed an official artist by the Government during the World War, and much of his work in that capacity is in the Imperial War Museum. He became a KBE in 1918 and RA 1919. His *Onlooker in France* (1921) is illustrated by reproductions of his own work. In his later years he painted

many brilliant portraits such as *The Chef*. Several of his works are now exhibited in the Tate Gallery.

Orpheus, in classical mythology a son of Apollo endowed in supreme degree with the gift of song; his music could move mountains and tame wild beasts. On the death of his wife Eurydice he descended to Hades to recover her; she was restored to him but he lost her again owing to his impatience to behold her face. In the later Greek world Orpheus became the centre of an elaborate semi-secret cult which spread very widely among all classes.

Orpiment, see ARSENIC

Orris Root, the powdered root of *Iris florentina* the common white-flowered iris about 15 in high. The plants were at one time widely cultivated in Italy for the perfume trade but the synthetic preparation of scents has almost ruined the industry.

Orthodox Church, see EASTERN ORTHODOX CHURCH.

Orthodoxy conformity to an established belief especially in the theological or religious sense as opposed to heterodoxy which implies a difference of opinion from that laid down as correct. Every school of thought—religious political philosophical etc—has its own orthodoxy. Orthodoxy has been defined as my doxy and heterodoxy as your doxy.

Orthopaedics a term strictly meaning the treatment of deformities in children but usually including the treatment of deformities and injuries in general especially those of the legs and feet. Joints and bones are treated for injury and disease the treatment of bone disease consisting sometimes of the administration of endocrine secretions and anti rachitic vitamins to stimulate growth of the bone. Contraction of the soft tissues near joints may be prevented by stretching the wound and grafting fresh tissue if necessary. Sometimes gradual stretching is employed. Affections of the nervous system are treated by the

application of suitable apparatus to prevent deformity and massage and electricity in later stages. Many nervous diseases however cannot be cured by orthopaedic methods. Congenital affections such as club foot flatfoot and spinal curvature are often treated by orthopaedic surgery.

Orthoptera, an order of Insects (q.v.) distinguished by the wings when present being dissimilar—the front pair being horny elytra the hind pair membranous—and by its biting mouth parts and negligible metamorphosis. The species are mostly of large or medium size and are adapted for running hopping flying digging or swimming although the aquatic species are few. The best known are the cockroaches crickets grass hoppers locusts mantises and the leaf and stick insects (q.v.).

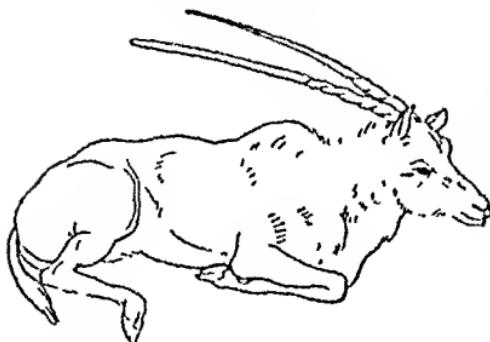
Ortolan, bird of the bunting family greatly esteemed especially in France for the flavour of its flesh. Ortolans are netted in numbers and fed on fattening seeds before being killed and dressed for the table.

Orvieto Italian city of great architectural interest in Perugia on the R. Paglia. The cathedral begun in the 13th cent and built of black and white marble is one of the most magnificent in the country and contains many beautiful frescoes statues silver work and carving. Pop c 20 000.

Orwell, Suffolk river rising some miles W of Stowmarket from which town it is navigable and flowing SE to its long estuary at the head of which Ipswich stands. It is a useful means of transport used chiefly for grain. Length c 30 m.

Oryz, a group of antelopes containing four species of which the white oryx is found in Arabia a more sandy coloured species in the Sudan the beisa in E Africa and the gemsbok in SW Africa the last two being darker in tint with the head black and white. They are about the size of donkeys and both sexes carry

long horns, slightly curved in the Sudan oryx but straight in the others



Oryx

Osaka, largest city in Japan, on a bay of the same name situated on the S coast of Honshu island. It is intersected by canals, and possesses good dockyards, but most of the exporting is done from Kobe (*q.v.*), which has better facilities for navigation. The main industries are cotton, ship-building, metal-goods, glass, and sugar. There is a university, numerous temples, and a fortified castle, one of the finest in the country. Osaka was founded about the end of the 15th cent. It has suffered from disastrous earthquakes, fires, and tidal waves. Pop (1930) 2,453,600.

Osborne, Dorothy (1627-1695), married Sir William Temple (*q.v.*) in 1655. Her *Love Letters* were published in 1888, and are among the most charming letters in English.

Osborne, Cowes, Isle of Wight, former royal residence, bought in 1846 by Queen Victoria. It was one of her favourite residences, and she died there in 1901. King Edward VII presented the house and grounds to the nation, and part of the house was opened as a convalescent home for Naval and Military officers in 1904. A year previously a college for the Royal Navy was opened there, but this was discontinued in 1921. The house is built in Italian style and the grounds are very picturesque. See *WIGHT, ISLE OF*.

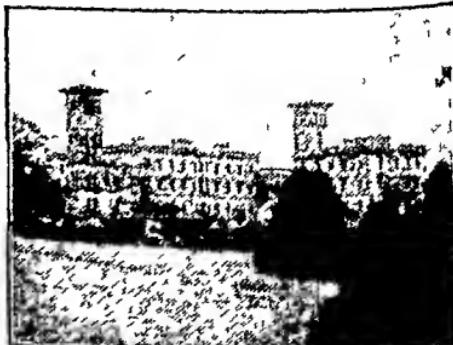
Oscar Language, see *ITALIC LANGUAGES*

Oscillograph, see *ELECTRICAL MEASURING INSTRUMENTS*.

O'Shaughnessy, Arthur William Edgar (1844-1881), English poet, was the author of an *Epic of Women*, which, with other poems, appeared in 1870. *Lays of France* (1872), *Music and Moonlight* (1874) and *Songs of a Worker* are other volumes of his verse. The one lyric for which he is famous, *The Fountain of Tears*, appears in Palgrave's *Golden Treasury*.

Osiers, species of willow grown for basket-making or wickerwork, or shoots of these willows. *Salix viminalis* and *S. caprea* are most often used, grown in good well-trenched and manured ground, naturally moist, but never covered by stagnant water, propagated by cuttings. The willow is dioecious (*i.e.* stamens and carpels in different plants) and the carpellate or female plants are most often grown. *S. viminalis* has straight and slender branches, with shortly stalked, almost upright elongated leaves, pure white beneath, and numerous sessile catkins 1 in long.

Osiris, the ancient Egyptian god of agriculture, art, science, and the underworld. He was considered to be reincarnated in the bull Apis, and the legend of the separation of his members after his death and the lengthy search for them by his sister Isis (*q.v.*) was one of the principal folk



Osborne House, a favourite Residence of Queen Victoria

stories of Egypt. Some modern investigators consider that his cult may be based upon memories of an actual person the inventor of agriculture and the other arts of civilization. See Sir J G Fraser *Adonis Attis Osiris*

Ossler Sir William Bart. (1849-1919) British physician was born in Canada and appointed Professor of Physiology at McGill University 1874 and of Clinical Medicine at Pennsylvania University 1884. He then became Professor of Medicine at Johns Hopkins University 1893 leaving to become professor at Oxford in 1903. In 1911 he was made a baronet. He wrote on nearly every branch of medicine and his works include *Principles and Practice of Medicine* a Monograph on *Cancer of the Stomach* 1900 *Science and Immortality* 1914 and *The Evolution of Modern Medicine* 1913. He also edited *A System of Medicine* 7 vols. 1905-10.

Oslo since 1825 the name for Kristiania the capital of Norway. It is situated at the end of an inlet of the Skagerrak and is a rapidly growing chiefly modern city including the seat of government the supreme courts and a university. The chief manufactures are cotton woollen linen and canvas goods and there are sawmills and paper mills brick works foundries and soap and tobacco factories. There is a very good harbour. The city dates from 1048 but has been largely rebuilt on a different site having been badly damaged by fires in its earlier years. Pop. 33 000.

Ottoman Pasha (c 1825-1900) Turkish general and statesman was educated at the military academy at Constantinople and fought in the Crimean War at Lebanon in 1860 and in the Cretan War in 1867. He was made a general in 1876 and participated in the Serbian War. In the Russo-Turkish War of 1877 he distinguished himself by his defence of Plevena. He was Minister of War from 1878-85.

Osmiridium (also known as iridosmine) a naturally occurring alloy of the metals osmium and iridium (q.v.)

belonging to the platinum group traces of other metals of this group also occur in the alloy.

Osmium, a blue-white metal one of the rarer metallic elements (see ELEMENTS). It occurs naturally in the metallic state but rarely pure being usually found as an alloy with in horn (q.v.) known as osmiridium. Osmium is also to be found in most platinum ores since it belongs to the platinum group of metals. Osmic acid is employed in microscopy as a stain as it gives a black colour to certain tissues caused by reduction of the oxide to the metal. It is volatile and very poisonous.

Osnabrück a city of Hanover Germany c 60 m SW of Bremen. It has a fine Gothic church and a Roman Catholic cathedral containing relics of Charlemagne. It has iron and steel works and manufactures musical instruments cotton and woollen goods chemicals dyes cement paper and tobacco. In the 9th cent it was a walled town. The bishopric was founded by Charlemagne in 783. Osnabrück was formerly the capital of a principality and in 1815 at the Peace of Westphalia it was stipulated that it be held by a Roman Catholic and Protestant prince alternately. In 1815 the principality became part of Hanover. Pop. 470 500.

Osprey medium sized bird of prey found nearly all over the world and the type of a family related to the Falcons but having the fourth toe of the foot reversible somewhat as in the owls. The osprey feeds on fishes which it catches by dropping from a height into the water and seizing them in its talons. It formerly nested in Great Britain but is now only a passage-migrant.

Ossa, a mountain in Thessaly (c 6000 ft) on which in Greek mythology Mt Pelion was piled by the Titans in their war against Jupiter in order to reach the heavens. Here the phrase from the *Odyssey* about raising Pelion on Ossa indicates a effort.

Ossian, the name of a legendary Gaelic bard, a "translation" of whose poems was published by James Macpherson (q.v.). It is probable that parts, at least, of Macpherson's "forgeries" were not fabrications, and that the bard did, in reality, compose some of the epic verse which had such a great influence on the Romantic Revival.

Ostade, Adriaen Van (1610-1685), the elder of two brothers, well-known Dutch artists. Ostade is supposed to have been a pupil of Franz Hals, and his work is typical of his country and time. His numerous paintings, drawings, and etchings are of the highest character, depicting almost every phase in the life of the Dutch peasantry. There are examples in the National Gallery.

Ostade, Isaack Van (1621-1689), the younger brother, studied under Adriaen, whose influence is conspicuous in his early work, both as regards subject and treatment. But he is best known for the landscapes of his later years, particularly for his winter scenes, with their well-arranged masses of small dark figures against backgrounds of ice and snow. The National Gallery has 5 of his paintings.

Ostend, Belgian port and popular holiday centre. During the World War it was occupied by the Germans, and used for some time as a submarine and destroyer base. The harbour is large and well equipped, and is the centre of the Belgian fishing fleet, and the town possesses excellent holiday attractions, including a good orchestra, a racecourse, and a casino. It was the



The Sea Front and Kursaal, Ostend

scene of a raid by the British Navy during the World War, when the *Viperfish* was sunk in the harbour, and the harbour partially blocked against us by German submarines. Pop. (1931) 47,300.

Ostia, Italian town and port of ancient origin, at the mouth of the Tiber. For many years the present town centred on the traditional salt manufacture which has now declined. Excavations, begun under Pope Pius IX in 1851, and continued by the Italian Government, have revealed some perfectly preserved Roman remains, including several temples, a number of houses and warehouses, theatres, barracks, and many tombs. A short distance upstream are two harbours, both constructed during the 1st century A.D.

Ostracism, a sentence of banishment passed by popular vote in Athens, derived from the Greek word for oyster, as oyster shells were used to record votes. Subsequently small pieces of pottery (ostraka) were employed, the name of the person to be ostracised being written by each voter. Ten thousand votes were necessary for a decree to be made. In the modern sense, the term applies to the ignorance of a person by the circle in which he usually moves.

Ostracoderms, a group of extinct chordate (q.v.) animals found in Upper Silurian and Devonian strata, whose affinities are quite unknown. The hind part of the body is scaly and fish-like, and they were formerly regarded as fishes, but the fore-part of the body is expanded and covered with a single plate or numerous plates and since there is no proof that they had jaws or limbs they have been classified with the lampreys and considered as constituting a separate class of vertebrates connecting the lampreys with the true fishes.

Ostrich, the largest known bird, considerably exceeding the emu and cassowary (qq.v.) in size and differing from them in having comparatively large wings and only two toes on the feet. The wings, however, are no

capable of flight but add considerably to the speed of the bird which can outstrip most horses as recorded in the book of Job. Ostriches live in the plains of Arabia and Africa and both cock and hen share in incubating the eggs. The cock has beautiful black and white plumes formerly fashionable for hat trimming.

Ostrogoths, name given to the branch of the Goths (*q.v.*) who became divided c. A.D. 370. At the same time they became subject to the Huns then invading Europe. Not until the downfall of the Huns did the Ostrogoths play a part in the history of Europe except as tributaries of the Huns. But in the 6th cent. the Ostrogoths are found as allies of the E. Roman Empire. Under Theodosius the Great the Ostrogoths conquered N. Italy and extended their power over the Goths in Gaul and Spain. With the death of Theodosius the power of the Ostrogoths rapidly declined. (See NARSES.)

Ostwald, Wilhelm (1853-1932) German chemist born in Riga was educated and spent the earlier part of his life in what is now Latvia. In 1897 he was appointed Professor of Chemistry in Leipzig and taught in that town until his retirement in 1906. His chemical researches were chiefly in the field of physical chemistry and he is known for his study of solution and his interpretation of their behaviour in thermodynamic terms. He also did a considerable amount of investigation on electro-chemistry and determined experimentally the characteristics of solutions of electrolytes. Ostwald was the recipient of the Nobel prize for chemistry in 1909.

Ottava Rima [OTAH VU RE ME] a stanza form of Italian origin used by Tasso and Ariosto and many others particularly for the purpose of romantic narrative. It consists of eight decasyllabic lines rhymed on three rhymes thus ABABABCC. It is the base of the Spenserian stanza (*q.v.*) and was used by Keats in his *Isabella* from which the following stanza is taken:

Wh h th ti ter di gree chur h yard (A)
And t h pell tek d m en l (B)
Work thr gh th I y y soil and gr v hard (A)
T sees H sh dbo and ne l l l (B)
Pity ge chf muth th gry de th b hm rd
(A)
And fitting t mo with human so l (B)
Ah! th sh d y wh tw f lg (L)
When Is bell by Lore kn it (C)

Ottawa (1) Capital of the Dominion of Canada in Ontario on the Ottawa R. The city is beautifully situated and is very handsome. First among its many important public buildings are the Houses of Parliament whose corner stone was laid by King Edward VII (then Prince of Wales) in 1860. Much of it was destroyed by fire in 1916 and subsequently rebuilt.

The main industry is lumbering huge quantities of timber being exported annually. There are also important flour iron and leather industries and many minor trades. The river provides a wealth of water power which is increasingly employed for the industrial and municipal welfare of the city. Pop. (1931) 1,7000. (2) River of Canada tributary of the St. Lawrence with a drainage area of c. 80,000 sq. m. It is used mainly for the immense lumber trade which is carried by its current to its confluence with the St. Lawrence. The Rideau Canal at Kingston connects it with Lake Ontario. Length c. 700 m.

Ottawa Agreements agreements regarding inter-imperial tariffs concluded at the Imperial Economic Conference held at Ottawa in the summer of 1932. Separate agreements were concluded between the United Kingdom and each of the Dominions as well as between the different Dominions for granting certain preferential tariff rates on inter-Empire trade.

The United Kingdom agreements with the various Dominions were similar in outline though differing in details. They were embodied in the Ottawa Agreements Act of 1932 and provided for the following:

A considerable list of commodities

on which the British Government had imposed a 10 per cent duty when the general tariff was put into operation in April 1932 appears in each agreement. The British Government undertook not to lower its 10 per cent levy on imports of foreign supplies of these products for 5 years. These goods meanwhile were to enter free from the Dominions and Colonies of the British Commonwealth of Nations. On this list of commodities the Dominions and Colonies were therefore to enjoy a 10 per cent preference in the British market for 5 years. The products consist of certain raw materials and foodstuffs which are important in the export business of the Dominions, such as leather, tallow, zinc, lead, timber, canned fish, dried and canned fruits, and a number of other products.

Additional duties were also imposed on foreign imports into the United Kingdom, comprising products for which different parts of the Empire were desirous of developing markets in Great Britain—apples and certain other fruits, butter, cheese, eggs, honey, and milk products, but not wheat, meat, or maize.

With regard to certain foodstuffs, on which they refused to put a tariff, the British Government maintained the right to regulate the quantity of total imports into the United Kingdom, by means of a system known as "quotas," but set certain proportions or amounts which should be permitted from each of the Dominions interested. These products included meat, fish, butter, cheese, eggs, and milk. The purpose of these regulations, according to the British Government, was to foster home production in the United Kingdom by the limitation of imported supplies and a consequent raising of price levels which would render home production profitable. The United Kingdom also entered into an arrangement whereby State action should be taken by the Government concerned to prohibit the export to the United Kingdom or Dominions, by any foreign power, of goods likely to have an in-

jurious effect on the agreements. Farmers in many parts of the United Kingdom have expressed the view that the British Government let them down at Ottawa by refusing to put a tariff on wheat and meat, and by their quota arrangements put millions of money in the pockets of Argentine and Danish producers.

The Dominions undertook to grant Great Britain increased preferential margins in respect of tariff duties on imports into their territories. This provision was to be carried out by increasing the duties on foreign imports of a long list of manufactured goods imported into the various Dominions and by decreasing the duties chargeable on imports from the United Kingdom on a number of other products. Dominions not already having tariff advisory boards undertook to establish them along the lines of the British Import Duties Advisory Committee established under the Imports Duties Act of 1932 (see TARIFFS).

Since most of the Dominions were anxious to foster a certain amount of industrial development within their own territories, they were for the most part unwilling to undertake to allow United Kingdom manufactured products free entry. In most cases, however, competition of the industries in the Dominions was not formidable so far as British manufactures were concerned. Longer experience, technical ability, and greater industrial facilities usually enabled the United Kingdom to produce products superior in quality and variety, and to furnish quantities which the newer industrial development in the Dominions could not equal. It was felt that the newer preference rates, when they came into operation, would tend to result in a sharing of the Dominion markets for manufactures between the large United Kingdom suppliers and the smaller Dominion industries. In the same way, the United Kingdom market for foodstuffs would be shared between the large Dominion producers and the smaller supplies produced in



RAPHAEL CARTOON THE DRAUGHT OF FISHES
(Reproduced by G. and J. Fawcett from / The W. J. of the K. A.)



King... RAPHAEL CARTOON DRAUGHT OF ST PETER
power, on the Draught of Fishes Reproduced by Gracious Permission of His Majesty The King

Great Britain *See also EMPIRE TRADE FOREIGN TRADE TARIFFS*

Otter the representative of a family of the carnivora related to the weasels and badgers but distinguished by its adaptation to aquatic life the hind feet and tail being enlarged and modified for swimming. Otters are found in rivers nearly all over the world except the Australian region and Madagascar and feed mainly on fish.

Otterburn, Battle of, Aug 9 1388 about 2800 Scots under the Earls of Douglas Dunbar and Moray routed a force of 8600 English under Henry Percy (Hotspur). The battle was fought by moonlight the English archery being thus rendered useless. Hotspur and his brother Ralph were among the captured and on the Scottish side Earl Douglas was slain. The battle is sometimes called Chevy Chase.

Otterhound, a rough-coated hound used for otter hunting but now superseded in many places by foxhounds.

Otter shrew a nocturnal fish-eating aquatic insectivore found in streams in W Africa and closely resembling a small otter in appearance.

Ottoman Empire formed when the Ottoman Turks under Osman declared their independence of the Seljuk Turks (7 v) at the end of the 13th cent. Under his successors Byzantine hold over Asia Minor was continually weakened until by 1300 only a few fortresses remained and the Turks had already crossed into Europe and taken Gallipoli. Under Sultan Murad I (1369-89) the Turks invaded Europe and conquered the outlying districts of the Byzantine Empire and some independent territories of the Bulgars though continually hampered by revolts in Asia which in 1400 grew to such alarming proportions as a result of the usurpation of Timurlane from Samarkand that the Turks were compelled to return. They were defeated by Timurlane at Ankara in 1402 but 10 years later their power revived and gradual extension into Europe was checked

only by joint action by Slavs and Magyars 1442. The allies were subsequently defeated by the Turks at Varna. Sultan Mohammed II (1451-81) established the Ottoman Empire firmly in Europe. In 1453 Constantinople was captured and the last vestiges of the Byzantine Empire extinguished. The Turks extended their power over S Serbia Albania and the Morea. The independent Turks in Asia Minor were also brought under the yoke of the Ottoman Empire.

The 16th cent marks the peak of Turkish advance. Practically complete control was obtained over the Balkans. The Magyars were defeated in 1526 Austria in 1529 then Egypt and Western Persia. It was a military Empire the Sultan was a soldier as were the grand Viziers. Semi-independent States acknowledging Ottoman suzerainty included Hungary Transylvania Moldavia Wallachia and the Hejaz. The army was efficient the peasants were contented with security of tenure. From the 16th to the end of the 18th cent corruption and military weakness alternated with military revival. By the peace of Karlowitz in 1699 Austria obtained Transylvania. Poland obtained the Ukraine and Venice the Morea and Dalmatia. In 1718 Turkey lost more territory to Austria who had advanced as far S as Belgrade and in 1738 she lost territory to Persia. By the treaty of Kuchuk Kainarji Russia was given the right to protect orthodox Christians under Ottoman rule.

The 19th cent saw the disintegration of the Ottoman Empire (for details see EASTERN QUESTION) under attacks by rising nationalities and Russia. Internally it was a period of maladministration and toward the end of reform and national revival Serbia obtained virtual independence in 1817. Greece complete independence in 1832. Romania in 1863 then Bulgaria in 1878 and Italy conquered Tripoli in 1911. Allied victory in the World War reduced Turkey in Europe to a narrow territory near Constantinople.

(now Istanbul) Iraq and Egypt obtained independence under English guidance, Palestine and Syria became mandated territories, and the Arabian principalities blossomed forth into independent States. In internal administration Turkey had fallen behind its system of the 16th cent. Corruption was rife, local government oppressive, and hatred of Christians led to massacres. Towards the end of the 19th cent reform movements started. The young Ottomans demanded constitutional government. In the '90's they were succeeded by the Young Turks, who were nationalist and constitutional. A revolution began in 1908, and a constitution was introduced. A counter-revolution followed, but was suppressed and the Sultan Abdul-Hamid was deposed. The new Government made determined attempts to introduce reforms. Foreign capital was attracted by concessions, but progress was hindered by war with Italy in 1911, with the Balkan States in 1912-13, and by the World War, 1914-18. Constantinople was occupied by the Allies in 1920. Kemal Pasha abolished the Sultanate and Caliphate in 1922. For later history of Turkish republic see TURKEY, MUSTAPHA KEMAL.

Otway, Thomas (1652-1685). English dramatist, one of the few writers of tragedy in the Restoration period. He wrote *Alcibiades* (1675), *Titus and Berenice*, *The Orphan* (1680), and the famous *Venice Preserved* (1682). He lived and died in great poverty.

Oubliette, an underground room or passage reached only by a trap-door in the floor above (Fr. *oublier*, "to forget"). Such places were used extensively in the Middle Ages for getting rid of enemies. They may originally have been intended as house-drains.

Oudenarde, Belgian town on the Scheldt, famous as the scene of the battle (1708), during the War of the Spanish Succession (*q.v.*), in which Marlborough defeated the French. Tanning and textile manufactures are carried on. Pop c 7000.

Oudinot, Charles Nicolas (1767-1847),

marshal of France. He served under Napoleon in the French Revolutionary wars and, at the head of the picked division of *grenadiers Oudinot*, distinguished himself at Austerlitz. After Wagram he was made Duke of Reggio.

Oudh (or *Oude*), an area of British India consisting of the eastern part of the United Provinces of Agra and Oudh, and lying between Nepal and the Ganges and between Agra and Bihar. Lucknow, where the chief court of Oudh sits, is the capital. The district chiefly produces rice, cotton, tobacco, opium, and sugar. In the 16th cent it was ruled by Mogul emperors, and c 1732 became independent under a Mohammedan dynasty. It was annexed by the British in 1856, and since 1921 has been under a governor. Its area is c 24,158 sq m.

Ouidah, see DE LA RAMÉE, LOUISE.

Ounce (1) see SNOW-LEOPARD, (2)

see WEIGHTS AND MEASURES

Oundle, market town, Northants, on the Nene, with a public school (650 boys) founded in 1556. Pop 2000.

Ouse, the name of four English rivers (1) The GREAT OUSE rises in the S of Northamptonshire, flows E into Bucks, and then N E into Bedfordshire. It turns in an irregular course S past Bedford, and then N E again to Huntingdon. In the Isle of Ely it divides into two artificial channels, the Bedford Rivers, the old course being known as the Old West River. Just below Ely it makes a final N turn, and passes across Norfolk to discharge into the Wash. The first 75 m are navigable. Length, 155 m.

(2) The LITTLE OUSE rises in Suffolk, flows N and then W to join the Great Ouse 10 m N of Ely.

(3) The YORKSHIRE OUSE is formed by the confluence of the Rs Ure and Swale, both of which rise in the Pennines and unite c 10 m S E of Ripon. The stream then flows generally S E through York, where it makes a sharp S turn, and Selby to the mouth of the Humber. There are several tributaries, including the

Wharfe Derwent Aire and Nidd. The river is navigable up to Ripon. Length 60 m.

(4) The SUSSEX OUSE rises N of Balcombe passes through the S Downs and enters the English Channel at Newhaven having passed through Lewes up to which point it is navigable. Length c 30 m.

Outlawry the state of being put outside the law i.e. deprived of all rights including the right to personal security under the law of the land. Dating probably from the reign of King Alfred it was originally used to compel a person accused of crime to appear before the court. Outlawry was practically equivalent to a sentence of death but towards the end of the 13th cent the wanton killing of an outlaw was forbidden. Sentence of outlawry though obsolete is still possible and still involves the loss of all civil rights and the forfeiture of property.

Outher geological term for a block of country composed of newer beds and entirely surrounded by older deposits. Most commonly this occurs on hills.

Oven-birds small S American insectivorous birds so called from their nests which are made of mud and straw in any exposed situation and completely closed except for the small entrance which leads into a passage half separated by a partition from the main chamber where the eggs are laid.

Overbury Sir Thomas (1581-1613) English author for his opposition to the love between the Earl of Rochester and the Countess of Essex he was imprisoned and murdered at the Countess's instigation. His poem *The Life* obliquely referred to the matter and was widely read. His literary importance rests on his *Characteres* a collection of interesting essays on types common in his day.

Overseas Loans, see EXPORT OF CAPITAL.

Ovid (*Publius Ovidius Naso* 43 BC-AD 1) Latin poet studied and practised law until his father a

death. He then devoted his life to writing poetry but in AD 8 he was suddenly exiled by Augustus for some reason unknown. He settled at Tomis in Moesia where he remained until his death. His works comprise *Medea* a tragedy (not extant), *Heroides Amores Ars Amatoria Remedia Amoris Metamorphoses Fasti* and *Tristia* (written in exile). His style is perfect for elegance and spontaneity and he is the master of elegiac poetry.

Owen John (1616-1683) English puritan divine supported the Parliamentarians in the Civil War and preached a sermon to Parliament on the day after Charles I's execution. He accompanied Cromwell as his chaplain to Ireland in 1649 and to Scotland in 1650. Owen became Vice Chancellor of Oxford in 1652 and Dean of Christ Church. He lost these offices on the Restoration and subsequently preached to the Independents in London. He wrote a number of theological works.

Owen, Robert (1771-1858) British social reformer son of a currier and inn-monger at Newtown in Montgomeryshire had little education but through his genius for administration had by the age of 19 become the manager of a large and successful cotton mill in Manchester. His business grew and in 1800 he became manager and part owner of the famous New Lanark mills the scene of his great experiments in social reform. He educated and clothed his workpeople opening for them a store and an infant school and in 1813 formed a new company in which Jeremy Bentham had shares. Educationists and reformers came from all over Europe to view this ideal mill and Owen's first book *A New View of Society* (1813) was widely read. He now entered public life and his report on the poor law (1817) was well received and his wish to make all industrial England into a greater New Lanark was enthusiastically if only theoretically endorsed by authority until he alienated many supporters by opposing organised religion.

Owen's eldest son ROBERT DALE

(now Istanbul). Iraq and Egypt obtained independence under British guidance, Palestine and Syria became mandated territories, and the Arabian principalities blossomed forth into independent States. In internal administration Turkey had fallen behind its system of the 16th cent. Corruption was rife, local government oppressive, and hatred of Christians led to massacres. Towards the end of the 19th cent. reform movements started. The young Ottomans demanded constitutional government. In the '80's they were succeeded by the Young Turks who were nationalist and constitutional. A revolution began in 1908 and a constitution was introduced. A counter-revolution followed, but was suppressed and the Sultan Abdul Hamid was deposed. The new Government made determined attempts to introduce reforms. Foreign capital was attracted by concessions but progress was hindered by war with Italy in 1911, with the Balkan States in 1912-13, and by the World War, 1914-18. Constantinople was occupied by the Allies in 1920. Kemal Pasha abolished the Sultanate and Caliphate in 1922. For later history of Turkish republic see TURKEY, MUSTAPHA KEMAL.

Otway, Thomas (1652-1685), English dramatist, one of the few writers of tragedy in the Restoration period. He wrote *Aleibiades* (1675), *Titus and Berenice*, *The Orphan* (1680), and the famous *Venice Preserved* (1682). He lived and died in great poverty.

Oubliette, an underground room or passage reached only by a trap-door in the floor above (Fr. *oublier*, "to forget"). Such places were used extensively in the Middle Ages for getting rid of enemies. They may originally have been intended as house-drains.

Oudenarde, Belgian town on the Scheldt, famous as the scene of the battle (1708), during the War of the Spanish Succession (*q.v.*), in which Marlborough defeated the French. Tanning and textile manufactures are carried on. Pop. c. 7000.

Oudinot, Charles Nicolas (1767-1847),

marshal of France. He served with Napoleon in the French Revolutionary wars and at the head of the fifth division of *grenadiers Gardes*, fought with him at Austerlitz. At Wagram he was made Duke of Reggio.

Oudh (or *Oude*), an area of British India covering of the eastern part of the United Provinces of Agra and Oudh and lying between Nepal and the Ganges, and between Agra and Allahabad. Lucknow, where the court of Oudh is, is the capital. The district chiefly produces rice, cotton, tobacco, opium, and sugar. In the 17th cent. it was ruled by Mogul emperor and c. 1732 became independent under a Mohammedan dynasty. It was annexed by the British in 1858 and since 1871 has been under a governor. Its area is c. 21,155 sq. m.

Ouidah, see DR LA RASSE, Louise.

Ouncos: (1) see SNOW LEOPARD; (2) see WEIGHTS AND MEASURES.

Oundle, market town, Northants, on the Nene, with a public school (55 boys) founded in 1536. Pop. 2700.

Ouse, the name of four English rivers. (1) The GREAT OUSE rises in the S. of Northamptonshire, flows E. into Bucks, and then N.E. into Bedfordshire. It turns in an irregular course S. past Bedford, and then N.E. again to Huntingdon. In the Isle of Ely it divides into two artificial channels, the Bedford Rivers, the old course being known as the Old West River. Just below Ely it makes a final N. turn, and passes across Norfolk to discharge into the Wash. The first 75 m. are navigable. Length 155 m.

(2) The LITTLE OUSE rises in Suffolk, flows N. and then W. to join the Great Ouse 10 m. N. of Ely.

(3) The YORKSHIRE OUSE is formed by the confluence of the Rivers Ure and Swale, both of which rise in the Pennines and unite c. 10 m. S.E. of Ripon. The stream then flows generally S.E. through York, where it makes a sharp S. turn, and Selby is the mouth of the Humber. There are several tributaries, including the

Wharfe Derwent Aire and Nidd. The river is navigable up to Ripon Length 60 m

(4) The Sussex Ouse rises N of Balacombe passes through the S Downs and enters the English Channel at Newhaven having passed through Lewes up to which point it is navigable Length c 30 m

Outlawry the state of being put outside the law i.e. deprived of all rights including the right to personal security under the law of the land Dating probably from the reign of King Alfred it was originally used to compel a person accused of crime to appear before the court Outlawry was practically equivalent to a sentence of death but towards the end of the 13th cent the wanton killing of an outlaw was forbidden Sentence of outlawry though obsolete is still possible and till involves the loss of all civil rights and the forfeiture of property

Outlier geological term for a block of country composed of newer beds and entirely surrounded by older deposits Most commonly this occurs on hills

Oven birds small S American insectivorous birds so called from their nests which are made of mud and straw in any exposed situation and completely closed except for the small entrance which leads into a passage half separated by a partition from the main chamber where the eggs are laid

Overbury Sir Thomas (1551-1613) English author for his opposition to the love between the Earl of Rochester and the Countess of Essex he was imprisoned and murdered at the Countess's instigation His poem *The Life* obliquely referred to the matter and was widely read His literary importance rests on his *Characteres* a collection of interesting essays on types common in his day

Overseas Loans, see EXPORT OF CAPITAL

Ovid (*Publius Ovidius Naso* 43 B.C.-A.D. 17) Latin poet studied and practised law until his father's

death He then devoted his life to writing poetry but in A.D. 8 he was suddenly exiled by Augustus for some reason unknown He settled at Tomis in Moesia where he remained until his death His works comprise *Medea* a tragedy (not extant) *Hercules Amores Ars Amatoria Remedia Amoris Metamorphoses Fasti* and *Tristia* (written in exile) His style is perfect for elegance and spontaneity and he is the master of elegiac poetry

Owen John (1616-1683) English puritan divine supported the Parliamentarians in the Civil War and preached a sermon to Parliament on the day after Charles I's execution He accompanied Cromwell as his chaplain to Ireland in 1649 and to Scotland in 1650 Owen became Vice Chancellor of Oxford in 1653 and Dean of Christ Church he lost these offices on the Restoration and subsequently preached to the Independents in London He wrote a number of theological works

Owen Robert (1771-1858) British social reformer son of a currier and ironmonger at Newtown in Montgomeryshire had little education but through his genius for administration had by the age of 19 become the manager of a large and successful cotton mill in Manchester His business grew and in 1800 he became manager and part owner of the famous New Lanark mills the scene of his great experiments in social reform He educated and clothed his workpeople opening for them a store and an infant school and in 1813 formed a new company in which Jeremy Bentham had shares Educationists and reformers came from all over Europe to view this ideal mill and Owen's first book *A New View of Society* (1813) was widely read He now entered public life and his report on the poor law (1817) was well received and his wish to make all industrial England into a greater New Lanark was enthusiastically if only theoretically endorsed by authority until he alienated many supporters by opposing organised religion

Owen's eldest son ROBERT DALE

OWEN (1801-1877), worked for his father's cause in America, where he succeeded in getting several reform measures passed

Owl, a nocturnal predatory bird, the type of an order distinguished by the radiation of the feathers round the large circular eyes, a short hooked beak, long talons on the toes, two of which are turned backwards, and soft, loose plumage which produces a silent flight. Owls prey mostly on small mammals like field-mice. A few, however, feed on fish. There are a great many different kinds, the largest being known as *eagle owls*.

Ox, a term sometimes employed in its plural form, *oæn*, as equivalent to cattle in general, but strictly applicable to a castrated bull.

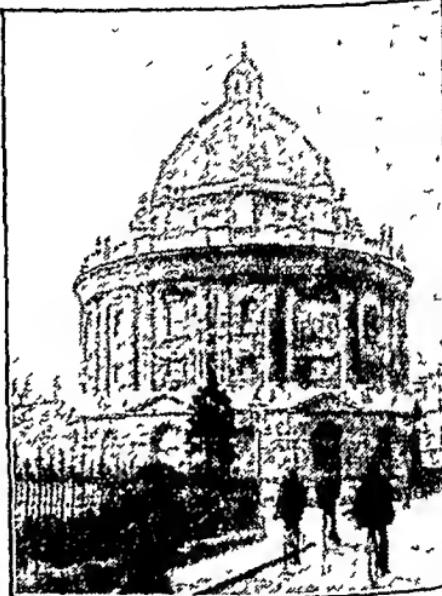
Oxalic Acid, HOOC COOH, is a colourless crystalline material melting at 101° C in the hydrated form, and at 190° C in the anhydrous state. It occurs extensively in nature, being found in several plants, and also in the animal organism in the latter as calcium oxalate. Oxalic acid is highly toxic. It is employed in the manufacture of numerous chemicals, as a mordant, as a bleaching agent, for the removal of ink stains, and in the manufacture of certain inks. See also SALTS OF LEMON.

Ox Eye (bot.), see ADONIS (bot.)

Oxford, county town of Oxfordshire, and senior university town of England, situated at the confluence of the Thames (Isis) and the Cherwell. The charm of the surrounding district, the architecture of the college buildings, and its many historical associations make it one of the most interesting English towns. Of the colleges and halls, Christ Church, whose chapel is the cathedral of the diocese, is the largest. University (1249) is probably the oldest (in spite of the claims of Merton), and St Peter's Hall (1929) the newest. Magdalen and New College are fine examples of Perpendicular. Wadham is very late Tudor. Queen's is Renaissance. Other buildings of particular note are the Bodleian

Library, Sheldonian Theatre (where the chief university functions take place), Ashmolean Museum, and Radcliffe Camera. After the War the town began to expand to some extent as an industrial centre, and the Oxford Preservation Trust was formed in 1927 to preserve its general appearance.

Oxford emerges into English history in the 10th cent.; it developed rapidly into an important ecclesiastical centre long before the university was founded. In the Civil War it was



The Bodleian Library, founded and permanently endowed in 1602 by Sir Thomas Bodley

a Royalist stronghold, and after the Restoration Charles II held a parliament there. Once a continuation of steady government set in the history of the town became almost entirely that of the university, with printing as the leading industry. With the establishment of the Morris motor-car factory at Cowley, a flourishing industry sprang up which considerably stimulated local trade. Pop. (1931) 80,510. See also OXFORD UNIVERSITY.

Oxford, Earls of, a title held successively by the De Vere and Harley families. The former held the title

OWLS

Great
eared owl



Snowy
owl



Barn
owl



Long-
eared
owl



Brown
owl



Burrowing
owl



from 1142 to 1703, the latter from 1711 to 1853, when it became extinct. In 1925 the Liberal leader, H H Asquith, was created Earl of Oxford and Asquith (*q v.*).

Oxford, Provisions of, ordinances passed 1258 by the Mad Parliament, (*q v.*) providing that there should be three sessions of Parliament every year, that an account of public moneys should be rendered, that the royal castles should be placed in the hands of English governors, and that four knights should be chosen from each district to set forth the grievances of their district. It was annulled by the Award of Amiens (*q v.*), 1204. It was the first public document issued in the English language.

Oxford and Cambridge Boat Race, *see Rowing*

Oxford and Asquith, Herbert Henry Asquith, 1st Earl of (1852-1928). British politician, b Morley, Yorkshire, educ London and Oxford, barrister 1876. His career at the Bar was signalled by his defence of John Burns against a charge of rioting in Trafalgar Square, and by his work in the Parnell trial. He was M P for E Fife 1886, Home Secretary under Gladstone 1892, and Chancellor of the Exchequer, under Campbell-Bannerman 1905, becoming Premier on the death of "C-B" in 1908, and retaining the office until 1916. His government was marked by the prolonged struggle over the Lloyd George Budget of 1909, and the consequent modification of the powers of the House of Lords by the Parliament Act, 1911. Asquith was a strong supporter of free trade, and handled home and foreign problems with vigour. He was instrumental in the settlement of the great railway and coal strikes of 1911 and 1912. In 1912 he introduced the Home Rule Bill which in 1914 led to the Curragh Incident (*q v.*), as a result of which Asquith himself became for a time War Minister, an office he still held at the outbreak of the World War. In foreign affairs he dealt firmly with the Agadir crisis in 1911, and, forming the

Coalition Government in 1915, he remained at its head until, in 1916, his position was impossible as the result of a crisis which arose over his alleged lack of grip in the conduct of the war. Lloyd George, his chief lieutenant, succeeded him.

Asquith lost his seat in 1918, but was returned for Paisley in 1920. On the Conservative defeat in 1923, he agreed to support conditionally the Labour Government that was then formed, but he lost his seat at Paisley in the general



The Earl of Oxford and Asquith

election of 1924. In 1925 he was raised to the peerage as Earl of Oxford and Asquith, soon after the General Strike of 1926 his health failed, and he died in Feb 1928. Asquith's wife died in 1891, and he married Margot, daughter of Sir Charles Tennant, in 1894.

Oxford Clay, a blue-grey clay, weathering brown, of Upper Jurassic age. It crops out from Dorset to Yorkshire in a belt of varying width, forming low, broad valleys, it occurs also in Skye and other islands off

W coast of Scotland It is thickest in Oxfordshire and is well exposed on the cliffs near Weymouth and at Scarborough It is important for brick making the Peterborough industry being especially famous bricks and other articles made from it are generally red in colour

Oxford Groups see BICHMAN FRANK

Oxford Movement, also known as the Tractarian Movement was an attempt to revive the Catholic tradition and practice in the English Church It was inspired by the perilous condition into which the Church of England had sunk in the early 19th cent In 1833 Hugh James Rose (1795-1838) Richard Hurrell Froude (1803-1836) William Palmer (1803-1885) and the Hon A P Perceval (1792-1853) met Hadleigh in Suffolk to discuss plans Conferences were held at Oxford in which John Henry Newman (1801-1890) and John Keble (q.v.) (1792-1866) also took part The result was an attempt to form an Association of Friends of the Church In the same year 1833 John Keble preached a sermon on National Apostasy and thus marks the initiation of the movement which celebrated its centenary in 1933 It was decided by the Friends of the Church to follow up the teaching outlined in the ideals set forth in the Association by issuing *Tracts for the Times* the aim of which was to prove that the doctrines of the Church of England are identical with those of the primitive Catholic church On account of these writings the movement became known as Tractarian Keble who wrote seven of the tracts insisted upon deep submission to authority and implicit reverence for Catholic tradition The first tract however was written by Newman Others followed down to 1841 when *Tract XC* put an end to the series This is the most famous or according to bitter opponents of Tractarianism the most infamous of all It was an essay by Newman on the Thirty nine Articles in which he maintained that these do not disavow catholicism and it

created tremendous controversy In spite of condemnation from all sides the Oxford Movement could not be arrested and soon after its foundation it had become one of the strongest forces in the internal and external life of the Church of England It led to the High Church or Ritualist movement or what is now called the Anglo Catholic movement It also led Newman to Roman Catholicism See Newman's *Apologia* and Church's *History of the Oxford Movement*

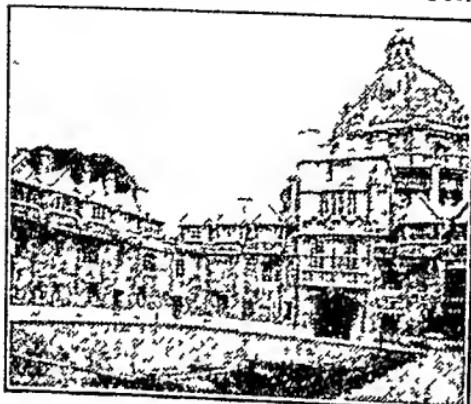
Oxfordshire (or Oxon) English county bordered N by Warwickshire and Northamptonshire S by Berkshire E by Buckinghamshire and W by Gloucestershire The surface consists of a moderately elevated plain between the Cotswolds and the Chilterns watered by the Thames with its tributaries and the Cherwell The soil is fertile sheep- and cattle raising and agriculture flourish The main crops are cereals vegetables and latterly sugar beet Minerals are not of particular value but some iron is obtained Industries are scattered the most important being the making of agricultural implement and machinery the Morris motor works blankets at Witney tweeds lace brick making and paper mills The chief towns are Oxford the county town (q.v.) Henley-on-Thames Witney and Woodstock Area 749 sq m pop (1931) 495 599

Oxford University came into being in the 13th cent when the city of Oxford was already 500 years old Before that time the nunnery of St Frideswide (8th cent) and the abbey at Osney (11th cent) were centres of learning The influx early in the 13th cent of Cistercians Franciscans Carmelites and other religious orders provided the necessary impetus for the foundation of halls and colleges In due course the teaching staff was recognised as a university with the powers of a corporation though it had an early rival in Stamford town various seceding granted in 1333 From

Oxford University

64

special privileges conferred on the University (notably the judicial powers of the Chancellor) led to collisions with the townsmen, and serious "Town and Gown" riots broke out in the 14th



Brasenose College, Oxford

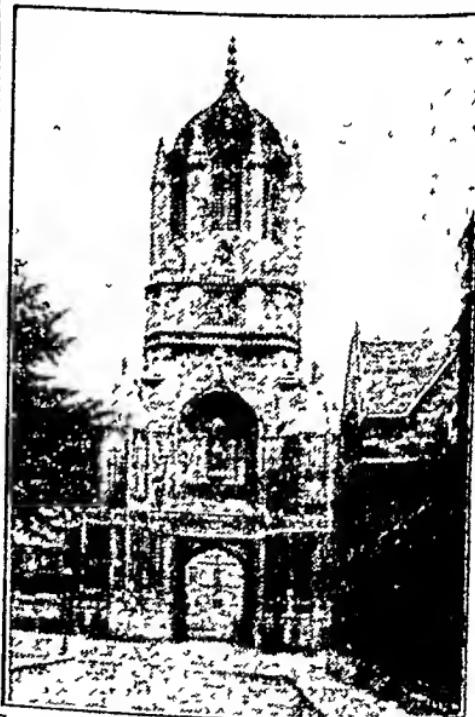
cent Their main result was still further to strengthen the power of the University, until a succession of royal charters made its position well nigh unassailable. Cardinal Wolsey (*q.v.*), though a great benefactor of Oxford, attempted to make his native city Ipswich "its twin of learning". In the Civil War the University declared for Charles I, who held his court at Oxford 1642-6. In 1919-20 women were admitted to degrees and "compulsory Greek" was abolished. The examination in Holy Scripture ("Divvers") is no longer an obligatory part of the course leading to a degree.

At Oxford and Cambridge undergraduates live in colleges and halls, or in licensed private lodgings. The machinery for conferring degrees is placed in the hands of the University. There is no University building as such, although many buildings at Oxford belong to the University.

There are 21 men's colleges and two halls, four women's colleges and halls, and organisations for non-collegiate students of both sexes. In addition there are six theological institutions, two private halls and a Labour college (Ruskin College) not affiliated to the University. The professors

number about 60, while there are about 60 readers, 300 fellows, 5,000 men undergraduates, and 800 women undergraduates.

The 21 men's colleges, in the order of their foundation, are University College (1249, but traditionally ascribed to the time of Alfred the Great), Merton (1264), Balliol (*c.* 1265), Exeter (1314), Oriel (1326), Queen's (1340), New College (1379), Lincoln (1427), All Souls' (1437), Magdalen (1458), Brasenose (1509), Corpus Christi (1510), Christ Church (1525), Trinity (1555), St John's (1555), Jesus (1571), Wadham (1610), Pembroke (1624), Worcester (1714), Keble (1870), Hertford (1874). All Souls' is unique in having only four undergraduates. The two halls are St



Tom Tower, Christ Church, designed by Wren in 1682

Edmund's Hall (*c.* 1220) and St Peter's (1929). It should be noted that, in some instances, the foundation dates given are those of the re-founding of an

o fer college either of the same or of a different name. For athletic purposes non-collegiate students are said to belong to St. Catherine's. The women's colleges and halls are Somerville, St. Hugh's and St. Hilda's Colleges and Lady Margaret Hall.

Oxidation in its primary sense means the action of the element oxygen upon other chemical elements or compounds. When oxidation takes place rapidly with evolution of considerable heat it is called combustion—the slow action of atmospheric oxygen giving rise to corrosion as in the rusting of iron and steel.

Ox Peckers, birds of the Starling family found in Africa and often seen on the backs of cattle and buffaloes feeding upon the ticks, bot flies and other parasites which infest these animals.

Oxus (Amu Darya) A large river flowing from the Timirs to the Aral Sea. It first flows N. forming part of the boundary between Afghanistan and the provinces of Tadzhik and Lashkard, then N.W. along the Uzbek-Turkmen border and across a wild desert to Kara Kalpek in Lao through its large delta into the Aral Sea. It is navigable to Charjui and there are fertile tracts along its banks in many places. The oasis of Khiva is dependent on the river for its fertility and the annual floods are diverted through irrigation canals to water the surrounding country. Length c. 1,500 m.

Oxygen, the most abundant and widespread of all the elements gaseous and non-metallc. It is found free in the air (q.v.) of which it forms about 21 per cent by weight in solution in water and in the form of its compounds is widely distributed both in non-living and in living matter. From the biological aspect oxygen is an essential element being the only substance capable of supporting respiration and hence life.

Pure oxygen is a colourless odourless gas the characteristics being given in the article ELEMENTS. It is of

interest to note that both liquid and solid oxygen possess considerable magnetic properties and the gas exhibits weak magnetism. Both the liquid and the solid are blue in colour.

Uses of Oxygen—The most important industrial use of oxygen is for the production of the extremely hot flames that are employed in welding. This is accomplished by the ignition of a mixture of acetylene, hydrogen or coal gas with oxygen, both gases being supplied under pressure.

Inhalation of oxygen is used to a considerable extent in medicine for the treatment of lung diseases and especially of carbon monoxide poisoning.

A recent use for oxygen which is increasing is in the manufacture of certain types of explosives (q.v.). These consist of an inflammable material such as for instance charcoal or sawdust which is impregnated with liquid oxygen, on firing with a fuse or else electrically a violent explosion occurs. Such explosives are being used in mines. They have two great advantages—the two substances can be transported safely since they are not explosive unless mixed together and should the charge for some reason or other not be fired it becomes innocuous in a very short time owing to the evaporation of the liquid oxygen.

The atomic weight (q.v.) of oxygen is taken as the international standard of atomic weights and is fixed at 16.0000.

Oyer et Terminer see COURT

Oyster a lamellibranch mollusc (q.v.) the cultivation of which has for the most important of the shellfish industries and was practised by the Romans about 100 B.C. The three countries now chiefly concerned are England, France and N. America. There are many oyster beds in Great Britain at Whitstable, Colchester, Rochester, Milton, Poole and oysters reared in beds on the London Clay near the mouth of the Thames are particularly well flavoured and known as *natives*. So-called *green* oysters popular in France are produced in

fattening ponds full of a minute blue alga on which the oysters feed. The "season" for oysters is from Sept to April—the months with an "r"—the summer months being the breeding time. An oyster matures in its third year. Each individual produces male and female reproductive elements, and the number of eggs has been computed to vary from several hundred thousand to many millions. The newly hatched larvae are expelled by the parent into the sea, where they swim about for a couple of days and may be carried far from the bed. They then settle on the sea floor and, if conditions are favourable, start fresh colonies.

Oyster Catcher, a bird of the Plover family distinguished by its black-and-white plumage, long red bill, and red

legs. It is common on muddy estuaries and sandy coasts, feeding on small water animals and using its strong bill for extracting mussels and shell-fish from their shells.

Ozokerite, a naturally occurring crude mixture of solid hydrocarbons. The raw material is of a black to greenish colour, and requires refining before it can be used. The uses of purified ozokerite are similar to those of paraffin wax, it has, however, a somewhat higher melting-point, which is of advantage for some applications. *See also CERLSIN, OILS, FATS, AND WAXES.*

Ozone, an allotropic modification of oxygen in which the molecule is triatomic, corresponding to the formula O_3 . *See also OXYGEN, BLEACHING, ELECTRO-CHEMISTRY.*

Paardeberg

Paardeberg Siege of ("nd Boer War) Feb 18-27 1900 5000 Boers under Cronje had entrenched themselves in the bed of the Tugela R. and were here surrounded by Lord Kitchener with 4 infantry brigades and 4 batteries. Lord Roberts arrived later and continued artillery fire brought about their surrender on the 27th. The British casualties numbered 1535 but 4000 prisoners and 8 guns were captured.

Pabst, G W German film producer specially known for his lighting effects and camera angles. In 193 directed Greta Garbo in *The Joyless Street* which did much to bring her to the forefront. Since then with *Secrets of the Soul*, *Westfront 1918*, *Kameradschaft* and *Don Quixote* he has steadily added to his reputation.

Pachmann Vladimir de (1848-1933) one of the most famous pianists of recent times and an unrivalled interpreter of the works of Chopin. His unique personality combined with his remarkable art won him great popularity throughout his long career. He studied for many years perfecting his technique making an occasional public appearance but always returning dissatisfied and it was not until 1889 that he felt a tour of Europe was justified.

Pachydermata, an obsolete term originally given by Cuvier to thick skinned ungulate mammals such as the elephant rhinoceros and hippopotamus.

Pacific Ocean, the largest ocean covers some three-eighths of the sea area of the globe. On the W it is bounded by the continents of Asia and Australia and the islands of the E. Indies on the E. by N. and S America. To the S it is widely open and extends to the Antarctic ice pack.

P

Paderewski

but N. it is enclosed except for the narrow Bering Strait between Siberia and Alaska by which it is connected with the Arctic Ocean. Its average depth of $3\frac{1}{2}$ m makes it in general the deepest ocean. Off the American coast the sea floor descends rapidly to over 9000 fathoms which depth remains fairly uniform over most of the eastern half of the ocean but the Asiatic coast is much indented with shallow gulfs and bordering seas and in the W Pacific there are large areas of water where the depth is less than 200 fathoms together with volcanic and coral islands. Nevertheless there are here also regions of over 5000 fathoms.

Pact of Corfu, see YUGOSLAVIA

Padang port on the W coast of Sumatra Dutch E Indies founded in the first half of the 17th cent. by the United Dutch E India Company. The hinterland is a favourite holiday centre and is rich in natural products such as coal spccs, rattan and quinine while coffee and copra are also produced in large quantities all these commodities being exported.

Pop (1930) 41 500

Paderborn town in Westphalia Prussia at the source of the Pader seat of a prince bishop from the time of Charlemagne to 1803 and of a bishop since 1817. It was formerly a member of the Hanseatic League. Manufactures include soap tobacco glass and beer.

Pop 33 000

Paderewski Ignaz Jan (b. 1860) Polish pianist and statesman. His career has been one of the most remarkable among modern musicians. From the 90's when he was a young virtuoso of stupendous powers and romantic appearance until to-day when his executive powers unimpaired he is held in even greater admiration as both pianist and patriot.

has been a picturesque and outstanding figure Born in Podolia, Poland, he studied at the Warsaw Conservatoire, and at Vienna under Lesehetitzky He first appeared in Vienna in 1887, and began a series of triumphs which he repeated all over the world His generosity and lifelong patriotism moved him during the World War to great efforts on his country's behalf He collected vast sums for Poland by concerts in the U.S.A., where he did valuable organisation and propagandist work, and his efforts were rewarded in 1919, when he became Prime Minister of his country He reappeared as a concert pianist in London in 1924, and had a moving and memorable reception

Padua, city in N Italy, on the R Bacchiglione, 22½ m W of Venice, from 1405 to 1797 an appendage of the Venetian Republic Some of the many fine buildings are the Palazzo della Ragione, the Eremitani Church, with Mantegna's frescoes, the Arena Chapel of the Annunziata, with walls painted by Giotto, and the Palazzo del Capitanio, with a staircase attributed to Palladio The University, founded in the early 13th cent, the picture gallery, and the botanical garden are famous Pop (1931) 131 066

Paganini [PAGAN'EENI], Nicolo (1782-1840) Italian virtuoso violinist, now almost legendary for his technical feats Paganini, born at Genoa, was taught the violin by his father, who put him through a severe course of training He first appeared in public at 9, his powers even then being remarkable He studied intensively until 1797, when he made his first tour in Italy, which was a great success From this time he made a series of increasingly extensive tours, while his fame spread wider In 1827 he was honoured by the Pope, and in 1831 appeared for the first time in Paris and London, where his playing created an enormous stir Honours and decorations were showered on him, and he commanded huge fees

Page, Walter Hines (1855-1918),

American publisher and Ambassador to Great Britain (1913-18), was on the staff of many American journals, including the *Atlantic Monthly*, which he edited (1898-9), and the *World's Work*, which he founded (1899) and edited (1900-13) As Ambassador to Britain, he opposed American neutrality in the World War. Success attended his efforts to induce America to declare war, in 1917, but his health had broken down, and he retired before the Armistice was signed

Pageant, a word originally applied to a scene in a Mediæval "Mystery" play, or to the stage or platform on which the scene was played These platforms were often mounted on wheels, and drawn in procession through the streets The term was later applied to processions of emblematic or allegorical groups without action or dialogue, the tableaux that form part of the Lord Mayor's Show are typical The modern form of pageant, consisting of a series of historical episodes illustrating the history of a town, locality, or institution, was developed in the first decade of the 20th cent It owed much to the genius of the dramatist and pageant-master, Louis N Parker, who organised the Sherborne pageant, the first of its kind, in 1905

Pahang, see MALAY STATES

Pahari Languages, a number of dialects spoken from the Punjab to Nepal along the S spurs of the Himalayas They belong to the Indo-European (*q.v.*) family of languages, but some of them have absorbed a certain amount of Tibeto-Burman influence

Pahlavi (or *Pehlevi*), properly speaking, the character in which the Zoroastrian sacred books were written but the term is now used to apply to the Persian language of the Middle period (c. 200-c. 600) This Indo-European language is characterised by the large Semitic element in its written vocabulary, but such Semitic words were only written, and in reading the Persian equivalent is invariably

pronounced. It is as if in English we were to write some such word as the Oceanic *tau* and pronounce it *man*.

Pain Barry E. O. (1867-1933) English humorist first gained attention with *Liza* (1900) and its many sequels. His works include *Play things and Industries* (1893), *Us and Harris* (1916), *Dumphy* (1917), and many clever parodies, e.g. *Another Englishwoman's Love Letters*, *Marge Atkinson* (1920), *If Summer Doesn't* (1921), and *This Charming Green Hat Fair* (1925).

Paine Thomas (1737-1809) English revolutionary author lived, wrote and held a number of positions in America from 1774 until 1787 including that of secretary to the Committee on Foreign Affairs. His famous *Rights of Man*, a reply to Burke's *Reflections on the French Revolution*, appeared in England in 1791. It had an enormous circulation but the government prosecuted Paine for alleged sedition and he fled to France. To-day it seems a very moderate work. His *Age of Reason*, an attack on religious revelation and inspiration, appeared in 1793. Paine was elected a member of the French Convention but Robespierre suspected him and he escaped the guillotine only by accident. He died in America but William Cobbett brought his body home.

Painlevé Paul (1863-1913) French politician and mathematician. He was elected member of the Académie des Sciences 1900 and became Socialist deputy for Paris 1906. Henceforward Painlevé devoted himself mainly to politics. He was Minister of Education in Briand's 1915 cabinet, Minister of War under Ribot 1916. In the same year he became Premier but resigned office within the year. He succeeded Jaurès at the head of a government forced to resign after 6 months in office. He was Minister for War in Lyautey's cabinet of 1916 and 1917 and for War under Mornac in 1918.

Paint. The art of making coatings consisting of pigments mixed with liquid media to preserve and decorate

materials and to render them water proof is known to practically all primitive people. In many parts of the world nature affords varnishes in the juices of various plants. White of egg, milk, blood and grease are all film mediators still used to carry pigment for coatings. Linseed oil (*g.v.*) is still the most largely used basis for paint owing to its quality of hardening by oxidation to a substance *linosyrene* which is practically insoluble in all ordinary solvents.

Oil paints are made by mixing pigments with linseed oil either pure or containing various resins and driers to some of which the term *japan* is applied.

A recent development is the greatly extended use of cellulose paints that is to say mixtures of pigments with cellulose lacquers described under *LAKKIR*. A great advantage of cellulose paints is that they do not show brush marks and yet dry very quickly before dust has time to settle. They are therefore pre-eminently adapted for indoor decoration but are also fairly resistant to atmospheric influences and in special qualities are used for motor-car bodies. Some of these paints are made with solvents so volatile that they cannot be applied by a brush but must be sprayed.

An important use of paint is to protect metals especially iron against corrosion (*q.v.*). For this purpose either linseed oil or asphaltum paints are used. The best anti-corrosive paint for iron and steel is probably red lead paint made by mixing red lead with raw linseed oil. This mixture will not keep fluid even when not exposed to air but quickly sets to a solid. A cheaper red protective paint is made with red oxide of iron. Graphite also is used in this paint. The use of aluminium paint, the best of which is made by mixing aluminium powder with a good oil varnish is becoming increasingly common on account of its decorative qualities.

Water paints or *temperas* consist of some form of water soluble colloid

generally glue, mixed with pigments and soluble mineral salts. Borax and alum are the salts most commonly used, they prevent putrefaction of the glue. A better medium than glue is casein (*q.v.*), the albumen of milk. This requires an alkali such as washing soda, ammonia, or borax, to dissolve it. If distempers are mixed with linseed oil or oil varnish in small proportion, they become insoluble in water, and can be cleaned by washing.

Tempera, the term applied to water paint used in artistic painting when the paint is held together by a gelatinous material, is probably the earliest form of paint used for artistic purposes, and continued in use until the invention of oil painting in the early 15th century. The artists of our own era used yolk of egg as their tempera medium, the early Italian paintings of Cimabue, Giotto, and the other Italian primitives were made with it. It was completely abandoned for many centuries, but various modern painters have taken it up with enthusiasm. The use of water colour (very finely ground pigment with hardly any binder, used in thin transparent layers on paper) of course continued, and indeed, greatly developed through contact with Eastern art, but recently the use of opaque tempera colour has become common for commercial work such as posters.

CONSULT *The Technology of Paints and Varnishes* (1927).

Painting The representation or depiction of objects or persons by applying colour to a regular surface.

Primitive Origins It is known that the impulse to depict human beings, objects, and animals existed among the inhabitants of the world thousands of years ago. The Aurignacian and Magdalenian cave-dwellers (11,000-7000 B.C.) left proof of this in their drawings, paintings, and carvings. Relics of artistic activities from before 2200 B.C. are the drawings and decorated ornaments found in Spain, where the astonishing and celebrated cave paintings are preserved at Alta-

mira, and the engraved plaques, frescoes, and wall-paintings of Babylonia and Assyria (early Sumerian period, 3000-2500 B.C.), Egypt and India. The period 2200-1100 B.C. produced mosaics, frescoes, and vase-paintings of Cretan, Cycladic, and Mycenaean origin, which were followed by the frescoes and vase-paintings from Greece and the Aegean, and the painted and glazed pottery from Assyria. Ancient painting can subsequently be traced through the Archaic (600-500 B.C.), Classical (500-330 B.C.), Hellenistic (330-300 B.C.), and Roman (from 330 B.C.) periods. The early Christian period (A.D. 200-400) produced the symbolic frescoes of the catacombs, and later developments were paintings and frescoes of the Byzantine (600-1100) and Romanesque (1100-1200) schools.

Middle Ages Cimabue's pupil Giotto (c. 1266-c. 1336) was the first great painter to break through the confining bounds of Byzantine formalism and depict human beings in a human way and nature naturalistically. These qualities were developed to a much greater degree by his successors, but it was Giotto who laid the foundations on which the great schools of later years were based. The works of the painters of the Sicilian school, which included Duecio (d. 1339) and



The Annunciation, by Fra Angelico

Martinu (d. 1344) betrayed Giotto's influence in their human feeling and decorative gaiety but his legitimate and equal successor was Fra Angelico (1387-1455). Ten years after Fra Angelico's birth came Paolo Uccello (1397-1475) who is important for his successful handling of perspective a problem that had more or less defeated his predecessors. One of the earliest and greatest of the company of 15th cent. Italian painters was Fra Filippo Lippi (c. 1406-1460) who had a greater



The Virgin Adoring the Child by Botticelli

pupil in Sandro Botticelli's (1444-1510) school. Botticelli's greatest pictures such as the Primavera and the Birth of Venus were not devotional in subject like those of his famous predecessors but were rather the expression of a joyous paganism. Other notable members of the 15th-cent. Italian schools were Umbrian Pietro della Francesca (d. 1492), Perugino (d. 1523), Signorelli (d. 1499), (Padua) Mantegna (d. 1506), (Venice) Jacopo (d. 1494) Gentile and his greater brother Giovanni Bellini (d. 1507 and 1516 respectively) and Carpaccio (d. 1525). Of these one of the most outstanding was Mantegna who introduced a marvellously sculptural quality into his paintings. Before and during the early Italian Renaissance painting was developing in other European coun-

tries. In Flanders for instance the brothers Van Eyck Hubert (d. 1426) and Jan (d. 1441) founded the Flemish School. The Van Eycks (c. 1400) were succeeded by Roger van der Weyden (1399-1464) who painted strong and dramatic religious pictures, and Hans Memling (1430-1494) who unlike some of the Flemish painters of this period combined a certain spirituality with the wonderful technique that was common to the whole school. In the Central European countries painting was represented at this period by William of Cologne (d. 1378), Martin Schongauer (d. 1491) in the Rhine land and Theodoric of Prague.

The Resurrection (from the French meaning re-birth). The work of the 16th-cent. painters of the early Italian Renaissance resulted in the wonderful pageant of great figures that pass in review with a survey of the 16th cent. There was no more picturesque



The Sistine Madonna by Raphael

more varied or more extravagantly gifted personality than the wonderful Leonardo (1452-1519). Of the young masters Michelangelo (1475-1564) and Raphael (1483-1520) the one expressed his colossal genius in the most powerful

representations, both in painting and sculpture, of the human body that have been known and the other achieved a marvellous synthesis of lyric tenderness, restrained power and easy mastery of composition. Of the great Venetian school one of the greatest figures was Giorgione (1477-1510), whose *Sleeping Venus*, completed by Titian is one of the most serenely beautiful paintings in the world. Other illustrious Venetian were Palma Vecchio (1480-1528) who shows Giorgione's influence, the great portrait painters Titian (1477-1576) and Tintoretto (1518-1594), Lotto (1480-1556), and Veronese (1528-1588). Other great painters of the various Italian schools of the Golden Age were (Florence) Sebastian del Piombo, (Umbria) Giulio Romano (1492-1546), (Milan) Bernardino Luini (1485-1531), (Parma) Correggio (1494-1531). In Germany two great artists arose in the 16th cent.—Albrecht Dürer (1471-1528) a draughtsman of great power and imagination, and the superb portraitist Hans Holbein (1497-1543), while in Flanders there were Quentin Matsys (d. 1530), Jan Mabuse (d. 1511), Lucas van Leyden (d. 1533), and P. Breughel (d. 1569).

The 17th Century. This period in Italy is notable for the foundation of the Bolognese school, whose object was to select and preserve the finest qualities of all the great painters who had preceded them. The founder of this Eclectic School was Carracci (1535-1610), whose academic principles influenced Guido and Domenichino. Other Italian painters of this century are Salvator Rosa (1615-1673), Carlo Dolci (1616-1686), Tiepolo (1692-1769), and the Venetian Canaletto (1697-1768). Beyond Italy many great names now begin to occur. In Flanders the Baroque period was magnificently inaugurated by the brilliant and prodigal genius of Peter Paul Rubens, whose art revealed new possibilities of colour and movement, and who influenced that master portrait

painter Antony van Dyck (1599-1641). Among the lesser Flemish painters who followed these two masters were David Tenier, (1582-1649) Cornelis de Vos (1583-1651), Frans Snyders (1579-1657) and Jacob Jordaens (1593-1678). In Holland, where, with the exception of Lucas van Leyden (1491-1533) no really distinctive painter had yet arisen,



Philip IV of Spain, by Velázquez

the Dutch school sprang into being with the lively and brilliant portraiture of Franz Hals (1581-1666), and the penetrating realism of Rembrandt (1606-1669). In contrast there followed the painters of domestic and pastoral scenes, two of the greatest of which are Pieter de Hooch (1629-1677) and Vermeer of Delft (1632-1675), whose works display a mastery of light and colour and detail. Others

of this school are Van Ostade (1610-1685) Jan Steen (1619-1679) Hobbeima (1638-1699) Ruysdael (1608-1682) and Cuyp (1620-1691). In addition there were the Dutch sea-cape artists Hendrik Dubbels (1600-1660) Ludolf Bakhuizen (1631-1708) and the skilful draughtsman William van de Velde the younger (1633-1693).

In Spain the 17th cent saw the rise of Velazquez (1599-1660) and Murillo (1618-1682). Domenico Theotocopoulos (b. 1546) a Cretan who as a young man studied under Titian at Venice produced at Toledo under the name of El Greco (the Greek) a series of remarkable pictures. Lesser members of the brilliant Spanish school who came between El Greco and Velazquez are Ribera (Lo Spagnuolo 1584-1656) Herrera (1591-1656) and Francisco de Zurbaran (1598-1664). Velazquez was born at Seville in 1599 and became a virtuoso among portraitists. The brilliance of Velazquez was not repeated in the style of Murillo (1618-1682) who though a pupil of the great portraitist developed a much less incisive manner which suited the sentimentalism of his subjects.

The school of national French writers that arose in this century had its sensational beginning and developed along more elegant lines than the forcible Spanish school. The contrast is emphasised in the works of Nicolas Poussin (1594-1665) whose landscapes are essentially classical in style and show a beautiful and dignified restraint in execution. He was followed by that distinguished landscape painter Claude Lorrain (1600-1665).

The 18th Century English artist is Ruthven (1692-1764) the two earliest painters of the English school Sir Peter Lely (1618-1680) and Sir Godfrey Kneller (1646-1712) being originally Dutch and German respectively. Ruthven retains all the great individuality and personality and he was a mercurial artist. He was followed by the first

of the famous 18th cent English portrait painters Sir Joshua Reynolds (1723-1792) who used his youthful study of the Italian masters to the greatest advantage in the superb and varied portraits of his maturity. A more individual artist was Gainsborough (1727-1788) who though influenced by Van Dyck developed a delicacy and lightness of touch which was unequalled by any of the other 18th-cent portraitists not excluding Romney (1734-1802). Greater vigour is seen in the warm and solid portraits of Raeburn (1756-1823). English landscape painting originated in the 18th cent with the works of Richard Wilson (1714-1782) and of Gainsborough. The school they founded included Albrecht Durer (1471-1528) George Morland (1763-1804) and John Crome (Old Crome founder of the Norwich School 1769-1821). One of his pupils John Sell Cotman (1781-1842) was with Thomas Girtin (1775-1802) one of the greatest English water colourists. Another English 18th-cent artist is the mystic and poet William Blake (1757-1827).



Scenes from a River

The 18th cent. in France found its ideal expression in the elegant paintings of Watteau (1684-1721), of Fragonard (1732-1806) and the mythological



La Comtesse de Clermont, by Nattier

decorations of François Boucher (1704-1770). These artists reflected various phases of the artificial and pleasure-loving existence of the French aristocracy before the Revolution, while Chardin (1699-1779) and Greuze (1725-1805) were more democratic in their choice of subjects. Other French artists of this period are Jean Marc Nattier (1685-1766), Claude-Joseph Vernet (1714-1789) and Nicolas Largillière (1656-1746). In Spain, a very different recorder of the manners and spirit of his time was José de Goya y Lucientes (1746-1828), who, as Goya, a bold adventurer and fearless satirist, painted some wonderful portraits.

The 19th Century Though no successor to Goya arose during this period in Spain, both France and England entered upon important stages of their artistic development. In France the first years of the 19th cent. are notable for the work of two opposing schools based on the one hand on the classicism of David and his pupils, and

on the other on the reactionary movement of the Romantics, led by Prud'homme and Delacroix. It was the younger artist, however, who launched the movement towards a warmer and more imaginative interpretation than offered by the frigid and narrow classical traditions. Géricault (1791-1824) and Delacroix (1798-1863) led the way with a series of pictures whose vitality and unconventionality shocked the elders as much as they inspired contemporaries. The ideas of Romantics were to a certain extent shared by Corot (1796-1875) and members of his Barbizon school, including Jules Dupré (1812-1889), Theodore Rousseau (1812-1867), Daubigny (1817-1878), who carried the Romantic movement into the sphere of landscape painting. Millet (1814-1875) showed sympathies in his beautiful and dignified peasant studies. These artists, with Charles Jacque (1813-1894), Bastien Lepage (1818-1884), J. Breton (1827-1896), and Meissonier (1821-1890), were opposed by



Rider with Lance, by Goya

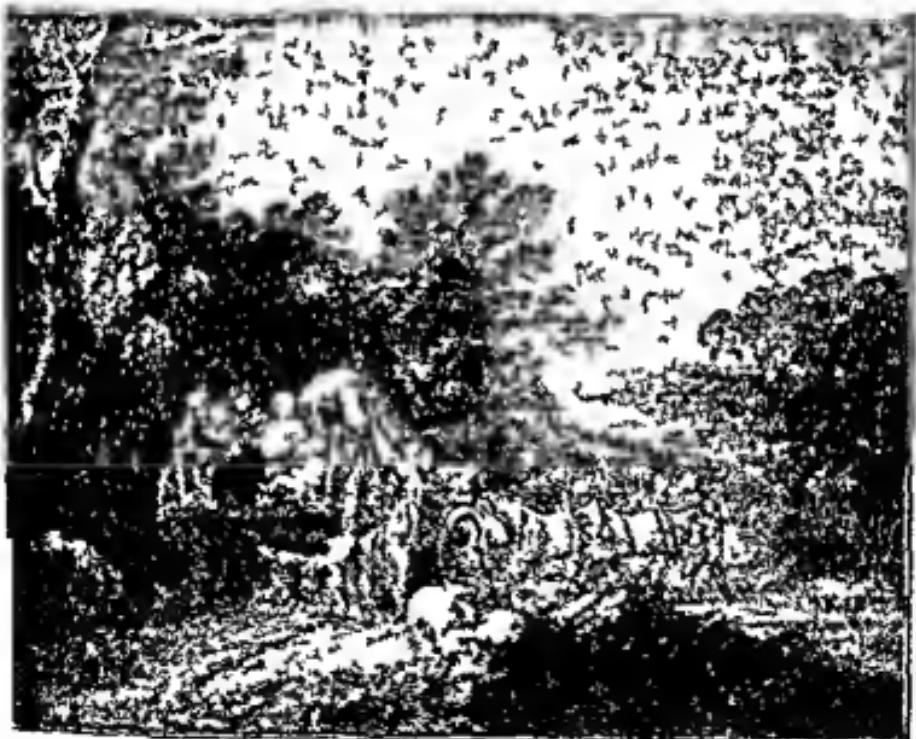
Realists, led by Courbet (1819-1877) and Manet (1832-1883), but both schools form a basis for the work of the



Portrait of Alfonso by Holbein.



Isabella Gonzaga and her Son by Titian.



The Harvest Wagon by Courbet.

Impressionists In England, a similar Romantic school arose when Holman Hunt (1827-1910), Dante Gabriel Rossetti (1828-1882), and others formed themselves into a "brotherhood" and were dubbed the Pre-Raphaelites, a title which their intense admiration for the masters who preceded Raphael made them proud to assume. Their aims at first were misunderstood and, as in the case of the French Romantics, some of their paintings were roundly abused for their morbidity and erudity. Of the painters who were accepted by the Victorians while the Pre-Raphaelites were ignored or denounced, Sir Edwin Landseer (1802-1873) is perhaps the most typical. The sentimental and photographic representationalism of his admired animal pictures appealed strongly to all classes from the Queen downwards.

This was the era of anecdote in painting, the unfolding of a story being a first requisite with many popular artists. Even landscapes were sometimes considered incomplete in themselves, and a line or two of verse from Sir Walter Scott or Lord Tennyson was added. The paintings of the Victorian interpreter of Hellenic glories—Frederick Leighton (1830-1896)—were held in such respect that, as Lord Leighton, he became the first painter-peer. A similar preoccupation with classical subjects, combined with a capacity for the life-like painting of marble, won Sir Lawrence Alma-Tadema (1836-1912) his knighthood. Two great landscape painters have not yet been mentioned for the reason that their paintings, which proved them brilliant colourists, make an appropriate link with the French impressionists. It is not surprising, in view of France's later preoccupation with the problems of colour and light, that the landscapes of John Constable (1776-1837) were appreciated in that country for their originality and brilliance long before England became aware of his merits. J. M. W. Turner (1775-1851), however, was

hailed in England, during the latter part of his lifetime, as a genius and master colourist, with his gaudily extravagant colour rhapsodies of sun-filled skies and luminous seas.

The heightened interest in the possibilities of colour which French painters since Delacroix had shown reached a climax with the rise of the new school. The first aim of the Impressionists is suggested by the name itself. They set out to give an impression of a scene as viewed in a flash, as distinct from a detailed representation, and in order to give this momentary effect most convincingly they adopted the new theory of colour based on the spectrum for the rendering of light and atmosphere. The "spectral palette" was the logical outcome of the theory that to paint sunlight the colours used must comprise those which the solar spectrum is composed of. This technique was carried to its advanced stages by the *Pointillists*, Pisarro (1830-1903), and Seurat and Signac, whose paintings consisted of dots of paint instead of brush strokes. Other prominent painters who all exploited the scientific analysis of light and colour were Claude Monet (1840-1926), Alfred Sisley (1839-1899), Auguste Renoir (1841-1919), Edgar Degas (1834-1917), who influenced that brilliant draughtsman, Toulouse-Lautrec (1864-1901).

In England the American artist James McNeill Whistler (1834-1903) shared with the Impressionists the belief that Pre-Raphaelite precision should be avoided, and betrayed a similar preoccupation with the problems of colour.

The Post-Impressionists followed a varied collection of painters sharing a common bias, namely, a reaction against prejudice against the complete realism that the science and virtuosity of the Impressionists had enabled them to achieve. To the Post-Impressionists, realism was desirable only in so far as it served as a means to an end, when it was the expression of an emotional idea. Rhythm, form, and design



Part II 1 L H R

4 End of I R



were to become increasingly important as factors in the new "expressionism" and the discoveries of the Impressionists were to be exploited no farther than was compatible with the ideals of later artists Paul Cézanne (1839-1906) and Van Gogh (1853-1890) were



Head of a Man, by Van Gogh

two of the greatest members of this company, who subordinated naturalism to ideas and emotions.

Paul Gauguin (1848-1903), like Cézanne, originally identified himself with the Impressionists, but he later found their aims inadequate for his own purposes, and used the simplification of natural forms to symbolise the characteristics of the exotic landscapes that appealed so strongly to him—those of the tropic South Seas, for instance, where he painted so many of his pictures. Georges Seurat (1844-1910) used the neo-impressionist *pointilliste* technique, but is notable chiefly for his mastery of design, which is displayed very impressively in *La Baignade* (late Gallery).

Various groups followed the Post-Impressionist period. The work of Gauguin gave rise to the Symbolist School, who shared with the Post-Impressionists the view that the aim of painting was to express ideas, but went farther, and held that that expression must be formal, symbolic and decorative. This school included Roussel, Vuillard, and Bonnard. Fauvism was also a movement towards

geometrical equivalent. These are even more extreme theories along the same lines were put into practice by Picasso during his Cubist period. Many painters were influenced by this movement, of whom one of the most important is Georges Braque. The Italian poet Marinetti led the Futurist



La Persane, by Matisse

to dismissed all the art which had preceded them and concentrated on trying to convey in painting by highly unusual methods a sensation of movement and activity. *Dadaism* was a noisy squib that soon exploded but *urrealism* is still arousing curiosity. Members of this cult base their aims on the teachings of Freud and claim to express dream-states by sensational and unconventional means which appear extremely ludicrous to the uninitiated.amous French painters who have been influenced by Fauvism, Cubism & by Cézanne are André Derain (b. 1880) Othon Friesz (b. 1879) Duyouer & Segonzac (b. 1884) Maurice Utrillo (1883) Maurice Vlaminck (b. 1886) and Jean Marchand (b. 1883).

In England Impressionism, Post Impressionism and the subsidiary groups referred to above have all had greater or less effect. The work of Walter Sickert has already been mentioned but other prominent members of the modern school in England include Wilson Steer and Sir George Clausen whose sympathies were with Monet and the Impressionists. The influence of the latter group is also evident in the work of J. S. Sargent though more in his landscapes than in his portraits while even in the individual art of Augustus John French influences can be traced. Among younger artists Duncan Grant, J. D. Fergusson and J. S. Peploe have perpetuated the old tradition of Franco-Scottish sympathy and in England the Cubist movement was reflected to a certain extent in the geometrical products of the Vorticist group of which Wyndham Lewis has been a prominent member and in some of C. W. R. Nevinson's work. Ireland has produced a famous artist in Sir William Orpen and Scotland two master draughtsmen in Muirhead Bone and Sir D. Y. Cameron. Modern French influences in other European countries has been manifested in Germany in the work of Hadamard, Pechstein, Max Slevogt and the gifted Franz Marc who was killed in the World War in Russia in the paintings of Kandinsky.

Bakst the latter particularly being well known in England by his designs for the Russian Ballet and Natalie Goncharova. The modern Dutch painters derive more from Corot, Millet and the Barbizon School than from the later French artists. They are represented by Josef Israels (1845-1911) Mauro Mesdag, Blommers (1845-1914) Matthew Maris (1839-1917) and his brothers James and Willem.

CONSULT Herbert Read *The Meaning of Art* (1931) *Art Now* (1933) Roger Fry *Vision and Design* (1920) Clive Bell *Art* (1914) *Since Cézanne* (1922) C. J. Holmes *A Companion of the Arts* (1931) John Van Dyke *History of Painting* (1921).

Painting on Fabrics, see BATIK
LAMPSHADES, **LEN PAINTING** AND
STENCILLING

Palaeography name given to the study of ancient scripts and writings as distinct from that of inscriptions on metal or stone (epigraphy). It begins with the science of papyrology for writing on papyrus involved considerable modification of the letters inscribed in stone or metal. Curves were easier to write than angles whereas the reverse of this is true of inscriptions upon stone. This change was the greatest factor in the development of writing and was confirmed by the substitution of vellum and parchment for papyrus. Thus Greek writing developed from angular capitals copied from the oil inscriptions to rounded *seals* (i.e. letters an inch high, hence large letters) and eventually to a smaller cursive style (*muscules*). Similarly Latin was first written in *massucules* (capital) then in *uncials* and then in *cursive muscules*. The chief difficulty in deciphering medieval European writing arises from the extensive use of contractions and abbreviations and from the fact that many of the letters are perplexingly similar.

Palaeolithic Age, see Stone Age

Palaeontology the branch of biology and geology which deals with

It is divided into two sections, palaeo-zoology and palaeobotany, which respectively have animals and plants as their subject-matter.

Palaeozoic Era, name given by geologists to the first of the four great eras into which geological time since the deposition of the first fossil-bearing rocks has been divided. It includes the Cambrian, Ordovician, Silurian, Devonian, Carboniferous, and Permian periods (*q.v.*), and represents a longer time-period than the other three eras together.

Palatinate, a name originally given to the district in Germany under the rule of the Count Palatine of the Rhine. It was situated about halfway between the source and mouth of the river and extended for some distance on both sides. Its capital was first Heidelberg, later Mannheim. It arose in the 11th cent. and in 1214 passed into the hands of the ruling house of Bavaria. It was separated again in 1255 and, in 1329, by treaty, the Elector Palatine secured a certain amount of Bavarian territory, which was given the name of the Upper Palatinate, the original territory being called the Lower or Rhenish Palatinate. Following the Thirty Years' War, early in the 17th cent., the Elector Palatine, Frederick V., was deprived of his territory, but the Lower Palatinate was restored to his son in 1648, the Upper Palatinate being kept by Bavaria. In 1777 the Elector Palatine, Charles Theodore, became also Elector of Bavaria, owing to the extinction of the Bavarian ruling family. The entire Palatinate then became part of Bavaria. Some territory was lost to France, Hesse, and Baden in 1802, and Baden still retains Heidelberg. The two Palatinates are now districts of Bavaria. The Rhenish Palatinate is W. of the Rhine. Its chief town is Speyer and its chief port on the Rhine is Ludwigshafen. It produces cereals, flax, tobacco, vines, and fruit. Its chief industries are iron-smelting and textile, leather, and paper manufacture. Its area is about 2,300 sq m. The area of

the Upper Palatinate is 3,725 sq m and its capital is Nürnberg.

Pale, The, or The English Pale the term first applied in the 15th cent. to that part of Ireland which was colonised by Henry II in 1171 at within which English law alone was valid.

Palermo, sea-coast city in N.W. Sicily, surrounded by mountains, except to the E., and producing large quantities of oranges and lemons. Palermo contains many buildings of historic interest, including the 14th-cent. Palazzo Chiaramonte and the two 16th-cent. city gates. There are a large museum, a university, and a modern harbour with wet and dry docks. Pop. 450,000.

Palestine, E. Mediterranean country famous chiefly as the cradle of two great faiths, Judaism and Christianity. It is bounded N. by Syria, S. by Egypt, W. by the Mediterranean and E. by Transjordan. Area, 10,000 sq m., pop. (1931), 1,035,000.

Relief and Water Systems. The surface divides itself naturally into three parts: the coastal plain, which narrows gradually N. to S. and is walled in at the N. end by Carmel, the central plateau which extends through Judea, Samaria and Galilee and is divided by the Valley of Jezreel and the Great Plain of Esdrælon, and the rift valley of the river Jordan, which runs in part considerably below sea level and includes the Sea of Galilee and the Dead Sea. The Jordan is the principal river, a number of short streams flowing W. from the mountains and water the coastal plain.

The coast is almost unbroken, save for the wide Bay of Acre. The coastal plain is fertile, and in places covered with a sandy loam suitable for the cultivation of the celebrated Jaffa orange.

The Climate, affected by the Mediterranean and the altitude, ranges from the sub-tropical climate of the Jordan Valley to the comparative temperate one of the coastal region of the hilly areas, as in the Jerusalem

district snow falls occasionally. The occasional droughts are as yet insufficiently guarded against. Normally there is an ample rainfall.

Flora and Fauna Lying at the intersection of the African and Asiatic regions Palestine has a remarkable variety of flora and fauna, particularly bird life. The chief animals are the camel, horse, hyena, leopard and numerous rodents. There are several kinds of snakes and insects.

Agriculture is the chief occupation, the main products being oranges, grapes, wheat, barley, olives and tobacco. Orange production is the most important. Experiments are being made with a variety of other fruits such as the grapefruit and the banana.

Industry While industry was almost non-existent before 1918, the introduction of capital and the arrival of Jews experienced in various industries and scientific processes have resulted in the establishment of a number of industries, notably cement and brick works, oil, leather goods, clothing and chemicals connected with the exploitation of the Dead Sea deposits. Of particular importance is the tourist industry. There are also a number of valuable medicinal springs.

Minerals Limestone, rock salt, sulphur and gypsum are widely distributed. The Dead Sea chemical deposits for which a concession has been granted are already being productively worked and boring for petroleum has for some time been conducted in the Dead Sea area.

Exports and Imports The principal items of export are citrus fruits, wine, articles of ritual and a growing list of manufactured articles such as artificial teeth, cement, leather goods, confectionery, chemicals, soap, etc.

Articles imported include building material, industrial machinery, textiles, chemicals, electrical equipment, motor cars, fuels, etc.

The chief towns are Jerusalem, the capital (c. 90,000), Tel Aviv (46,100), Jaffa and Haifa. Tel Aviv is the only

completely Jewish city in the world having grown to its present size during the past 20 years.

Religion and Education The majority of the population are Moslems, Jews and Christians in that order. Each of the three communities maintains its own schools, though the government schools are mainly used by the Moslems. The Hebrew University is the only one in the country.

Government The country under British mandate is governed by a High Commissioner and an Executive Council. In 1927 the Jews were organised as a community with a limited autonomy. There are three administrative districts—Southern (Jaffa), Northern (Haifa) and Jerusalem. Under an ordinance of Aug. 1933 a wide measure of municipal government was granted subject to strict central control. Women's franchise exists only in Tel Aviv.

Communications are fairly well established—a fine system of roads supplements the railway system. The country is served by the British and Dutch air services to the Far East. Haifa Harbour was completed during Aug. 1933. The port of Jaffa serves the S part of the country and plans are in hand for its improvement.

Archaeology The Mandate provides for careful control of the country's antiquities. These are of great interest in view of Palestine's role as the cradle of Judaism and Christianity and the scene of Biblical events. Much has been done by the Palestine Exploration Fund, the Hebrew University and a number of other institutions and individual investigators. Important finds have been made including those at Gaza, Tel-el-Hesi, Jericho and Tel Marzeh, and the excavation of ancient synagogues in many parts of the country.

History The country emerges into recorded history through its early contact with Egypt whose domination began c. 10th cent. B.C. After its occupation by Israel it consisted of loosely confederated tribes which later

merged into a kingdom, and still later split up into the kingdoms of Israel and Judah. These were affected by the rise of the Syrian, Assyrian, and Babylonian powers, becoming a buffer between these powers and the rival kingdom of Egypt. The coastal plain provided the only practicable highroad along which the various armies could move N or S. Thus Palestine was eventually subjugated by the Assyrian and Babylonian Empires, and the kingdom of Israel came to an end. There followed the rise of the Persian Empire, and the return to Palestine of many of the descendants of those who had been taken into captivity. These were influential in reviving the cultural and national life of the people.

The coming of the Greeks under Alexander the Great found Palestine weak and disunited. After Alexander's death, the country fell to Ptolemy, the Greek king of Egypt. The rule of the Ptolemies was despotic, but on the whole not oppressive. The Seleucids in the 2nd cent dispossessed the Ptolemies, and their efforts, under Antiochus Epiphanes (170 B.C.), to destroy the Jewish faith and replace it with the Greek met with violent resistance under Judas Maccabeus, who secured religious freedom for the Jews. As Greek influence waned the Jewish leaders regained the reins of government, until the Roman conquest in the 1st cent B.C. made Herod King of the Jews under Roman authority. But this authority was distasteful to the Jews, who rebelled in 70 A.D., and were crushed, the city of Jerusalem being destroyed, and the country laid waste. A determined revolt under Bar Cothiba (132-5 A.D.) secured political independence for three years. This revolt was eventually crushed by the Romans following a war of extermination in which, it is estimated, more than a million Jews were killed. Jerusalem was demolished and rebuilt as a pagan city under the name of Aelia Capitolina. With the partition of the Roman Empire into W and E., Palestine fell to the latter and enjoyed comparative peace until

it was overrun by the Persians, who, with the help of the Jews, occupied the country. It was subsequently reconquered by Byzantium, which held it until its conquest by Omer in 636 A.D. Palestine under the Moslems suffered the various vicissitudes to which Islam in that part of the world was subjected. During the Crusades (q.v.) it passed from Moslem to Christian hands and back again until its fate was decided by the victory of Saladin at Hattin (1187).

In the 13th cent Palestine, in common with the rest of Asia Minor, suffered from the devastating incursions of Tatars, and in the beginning of the 15th from those of the Mongols under Tamerlane. The following cents saw the country settle down into a state of complete decay, under the rule of the Turkish Empire, from which it is only now beginning to recover.

The end of the 19th cent saw a great and growing interest in Palestine, both on the part of the Jews under the influence of the Zionist movement, and through the political ambitions of the European powers. In the 20th cent. the greatest factor in the development of the country has been the Zionist movement. Before the World War Jews had already begun, under great difficulties, to establish agricultural colonies, to introduce industries, and to institute a comprehensive school system. Jewish immigration and development, however, received their greatest incentive from the Balfour Declaration of 1917, which announced the British Government's decision to facilitate the establishment of a Jewish national home. The acceptance of the League of Nations mandate by Britain after the World War was followed by steady Jewish expansion. It is estimated that since 1918, the Jewish population has increased from 80,000 to c. 230,000, and that Jews have invested some £50 million in the country. Some 200 agricultural settlements have been set up by them, as well as a University.

Palestine, Operations in (1915-18) Beginning in defence of the Suez Canal the campaign widened into an invasion of Palestine and Syria. In Feb 1915 the Turks reached the Suez Canal which was defended on its W bank. They were repulsed and owing to the pressure exerted on the Turks in the Dardanelles Campaign (*q.v.*) the attacks temporarily ceased. The difficulty of defending the Canal from near its banks induced the British to attempt an advance across the Sinai Desert to El Arish in order to block the N route from Rafah near the coast and across the desert and threaten southern communications if they used the two more S routes. The oasis of Quatiya was occupied in April 1916. In July 1916 a force of Turks was defeated at Romau. In Dec 1916 El Arish and later Rafah were occupied. Difficulties of supply particularly water which had to be brought in a pipe line from near the Suez occasioned considerable delay in the advance but by the end of 1916 the southern frontier of Palestine was occupied and the approaches to the Canal severed. The War Cabinet ordered an advance into Palestine. In March 1917 the capture of Gaza was attempted but failed. The Turks held the strong positions from Gaza to Beersheba. For a time operations were confined to trench warfare before Gaza. Meanwhile General Allenby had been appointed commanding officer and he received considerable assistance from the Arabs who encouraged by Colonel T E Lawrence continually hampered Turkish movements in Arabia.

In Oct 1917 Allenby directed his main efforts against Beersheba and the Turkish left Beersheba was captured and the Turkish left defeated Oct 30-31. Gaza was attacked the following day and fell on Nov 6. The Turks were able to retreat N and were held by a small British force while Allenby marched on Jerusalem which he failed to capture. He seized important passes in the hills of Judea

and later in the year Jerusalem fell. In the spring of 1918 two raids E of the Jordan were made with the co-operation of King Feisal's Arabs on Deraa and Amman in the latter of which a specifically Jewish force participated alarming the Turks and making them strengthen their left. Allenby attacked their weakened right and utterly routed them at the battle of Megiddo (*q.v.*) in Sept 1918. The Turks were attacked on the left flank by the Arabs in Transjordan and their retreat cut off. Damascus was captured on Oct 1 and Aleppo on Oct 6. On Oct 31 an Armistice was signed.

Palestrina Giovanni Pierluigi da (1525-1594) Italian composer whose works consist mainly of sacred music.

He was appointed choir master of St Peter's Rome in 1571 under Pope Gregory XIII who instructed him to purge Church music of its imperfections. Palestrina remained in office until his death and during that time composed countless musical works includ-

ing nearly 100 Masses some hundreds of motets and many hymns litanies etc all of which are of high merit.

Paley William (1743-1805) English theologian lecturer a moral philosopher at Christ's College Cambridge 1768 and archdeacon of Carlisle 1782. His lectures published as *The Principles of Moral and Political Philosophy* (1785) remained for many years the text book for Cambridge University. His most notable works are *Law of the Evidences of Christianity* (1794) and *Natural Theology* (1802). In these he sought to prove the divinity of Christ and the truth of the



Palestrina

Christian religion by a theory of divine evolution and revelation

Palgrave, Francis Turner (1824-1897), English poet, critic, and editor of the *Golden Treasury of English Songs and Lyrics* (1861), a standard anthology of English lyric verse. He held a position in the Civil Service, and a professorship at Oxford. His chief critical work, *Landscape in Poetry* (1897), has some value, but his poems are not widely read.

Pali [PAHLI] Language and Literature. The language was a member of the Indo-European (*q.v.*) family of languages, related to Sanskrit (*q.v.*), and became the medium in which Buddhist classical literature was written. The Buddhist scriptures are preserved in three *Pitakas* ("baskets"), apart from which there are two important chronicles of Ceylon in Pali, the *Dipavamsa* and the *Mahavamsa*.

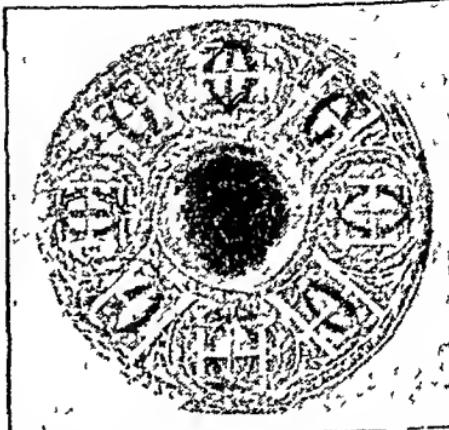
Palimpsest, a parchment or vellum manuscript, the original writing upon which has been rubbed off with pumice to make place for further writing. Not infrequently manuscripts have been found of unimportant works written over faint traces of far more valuable writings, and sometimes these traces have been made legible by chemical means.

Palindrome, a word, phrase, or sentence the letters of which read the same from right to left as from left to right, e.g. *Was it a cat I saw?* It is a device which lends itself more readily to the Latin language, and many of the later Latin poets exercised their ingenuity to the full in its use.

Palissy, Bernard (c. 1510-1589), French potter, was at first apprenticed to a glass-painter. He spent many years in unsuccessful attempts to discover the secret of enamelling pottery, bringing himself and his family to poverty, until he was reduced to using the furniture and floor-boards to fire his furnace. He attained a measure of success in 1555, and the Palissy pottery which he subsequently produced became famous throughout France and elsewhere. His dishes and

vases are rich in colouring and ornamented with skilfully modelled animals and fruits in high relief.

He died in the Bastille, where he was



Palissy dish. The border is pierced with the interlaced ciphers of Henry II
imprisoned in 1588 for his Huguenot beliefs

Palladium, rare metallic element belonging to the platinum group, found in association with the other platinum metals, and with gold, and obtained from nickel ores treated by the Mond carbonyl process (see NICKEL). Palladium is a grey-white metal with the power of absorbing a very large amount of hydrogen, to which it is permeable when heated (see ELEMENTS). Palladium is used for a variety of purposes. Alloys of gold and palladium have a white colour, and are employed in jewellery and dentistry. The pure metal is employed for the manufacture of watch springs and of mirrors. In the finely divided form as palladium black and sponge it is used in chemistry as a catalyst, chiefly in the activation of hydrogenation reactions.

Pallium, see VESTMENTS

Palmerston, Henry John Temple, 3rd Viscount (1784-1865), English statesman, born at Broadlands, near Ronsey, Hants, and educated at Harrow and St. John's College, Cambridge. At 18 he succeeded his father, and, the peerage being Irish and not

precluding membership of the House of Commons he entered Parliament in 1807. The Duke of Portland gave him a junior Lordship of the Admiralty and at 20 he refused the Chancellorship of the Exchequer accepting the position of Secretary for War which he held for 20 years refusing promotion. During this period he showed himself a staunch supporter of Tory policy a man of fashion and a witty writer. In 1828 he was in opposition and turned his attention to foreign affairs. Two years later he refused a seat in Wellington's Government and went over to the Whigs becoming Foreign Secretary under Lord Grey. He helped to secure the independence of Belgium and the pacification of the Spanish peninsula and worked to secure the regeneration of Turkey. His strong feeling and unbridled language in foreign affairs however outweighed his qualifications as a Minister and from 1841 to 1846 he was without a portfolio. He was then made Foreign Minister under Lord John Russell and immediately became embroiled with France over the marriage of the Spanish queen. He supported Italian independence.

Palmerston's arbitrary and independent action rapidly increased his unpopularity abroad except in France and his friendship for the Republic offended Queen Victoria. After he had sanctioned an expedition to Greece in consequence of an attack on a British subject he justified himself in the Commons by declaring the principle that British subjects should everywhere be protected if necessary by the force of British arms. This was the most famous speech of his career remembered for his quotation of the proud Roman boast *Civis Romanus sum (I am a Roman citizen)*. It won a Parliamentary victory and made Palmerston the most popular man in Great Britain. In 1851 after congratulating the French Ambassador on Louis Napoleon's coup he was removed from office and his career in foreign affairs ended for good. In spite

of this disgrace he became Home Secretary 1853 and on the failure of Lord John Russell was made Prime Minister in 1855 in time to accept the popularity of victory in the Crimea. Although opposed by both Disraeli and Gladstone he maintained a strong government with only a year's break until his death in 1865. He opposed the Suez Canal project on the grounds that it would increase French influence in the East. In the American Civil War he supported the policy of neutrality but was not averse to the disruption of the Union. Palmerston in spite of his impulsive and obstinate foreign policy was a constant enemy of injustice and oppression and in private life a character of great charm. He was buried in Westminster Abbey. He was one of the most typical Englishmen of his generation and standing for British security and strength was long regarded as the most powerful man in Europe and the protector of small nations.

Palmistry the science of hand reading an ancient practice regarded in the Middle Ages as a black art. It purports to read character from the shape and texture of the hand fingers and nails and past and future happenings from the lines on the palm.

Palmic Acid, a widely distributed naturally occurring fatty acid ($\text{C}_18\text{H}_{34}\text{O}$). It is a saturated acid having the formula $\text{C}_18\text{H}_{34}\text{O}$.

Palm Kernel Oil, fatty oil obtained from the kernels of the palm fruit different in its characters from the palm oil ($\text{C}_18\text{H}_{34}\text{O}$). Palm kernel oil is chemically similar to coconut oil and is used for the same purposes as the manufacture of margarine and soap. The principal sources of palm kernels are the W coast of Africa and the Dutch E Indies.

Palm Oil, fatty oil obtained from the pericarp of the palm fruit not to be confused with the oil obtained from the kernels of the fruit, which is different in its chemical character. Palm oil is used to a large extent in the manufacture of soap in the tin plate

industry to protect hot metal from oxidation, and as an edible fat. The principal sources of palm oil are the West Coast of Africa and the Dutch East Indies.

Palms, trees of the order **Palmaceæ**, the largest monocotyledons, natives of tropical and warm temperate regions. There are more than 1000 species, most of which exhibit a tall unbranched stem, 150 ft high in some species, which ends in a crown of large featherly leaves. The sheaths of fallen leaves remain attached to the stem and give it a rugged aspect. The flowers are borne in branching clusters, generally in the axils of leaves, and the fruit is sometimes berry-like, sometimes like a coconut. One species is found in the Mediterranean region but



such as the elephant (*Coco nucifera*), the oil-palm (*Elaeis guineensis*), betel (*Areca catechu*), and date (*Phoenix dactylifera*). The vegetable ivory palm (*Phytelephas*) is peculiar in having a dwarfed stem, with leaves radiating from the base. In addition to the food furnished by the date and coconut the stems of some kinds of palm yield sugary or starchily liquid. Palm leaves are woven into baskets, thatch, and other articles, and oil for thatching.

Palmyra (modern *Tadmor*)
was a city now a heap of
ruins in desert, 150 m. N. V.
of Hama known to the E-
gyptians, etc., it stood at
intersection of trade routes
from east and the straits
but

honoured by the erection of a column along an avenue, at one time nearly $\frac{1}{2}$ m long, leading to the temple Efficient civil servants were entitled to build a splendid tomb, many of which remain near the ruined city About the 1st cent. A.D. Palmyra came under the Roman Empire, and until the 3rd cent A.D. was very powerful In a revolt c A.D. 273 the people were massacred and the city destroyed It became Christian, then Moslem In the 14th cent. it sank to obscurity Re-discovered by a European in the 17th cent., its ruins have since been considerably explored

Palmyra, Siege of. *see* EMESSA

Pamirs, sometimes called the Roof of the World, a group of mountains in NW India and Turkistan, from which radiate several ranges, including the Himalayas, Hindu Kush, Karakoram, Kuen Lun, and Tien Shan. The Pamirs are c 18,000 ft high and almost barren of vegetation, and are the source of the river Amu Daria, or Oxus, which drains into the Aral Sea. They are thinly populated by Kirghiz tribes.

Pampas, the grasslands of the temperate regions of S America, between the Andes Mountains and the R Paraná. They form grazing ground for huge herds of sheep and cattle, and furnish large quantities of wheat and maize.

Pampas Grass, *Cortaderia* or *Gyne-*
rium argenteum, a handsome grass of
the order Gramineæ, native to the
Pampas (*q.v.*) of S America. It grows
in a tuft several feet in diameter, with
long arching ribbon-like leaves about
6 ft in length, and its plume-like in-
florescences are on long stalks
which may often y are

often for decorative purposes has been imp-
lanted by the lay

that is benign and at the same time of all that is terrible in Nature and so he has given his name to the English word *pannic* signifying blind unreasoning terror induced by natural forces beyond the control of man.

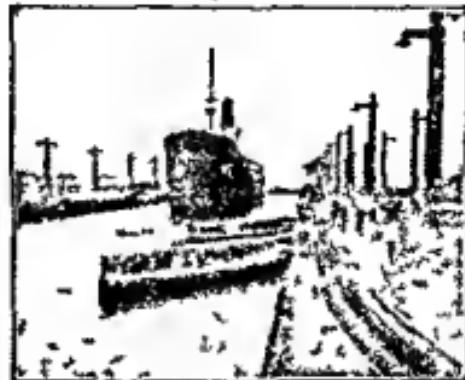
Panama (1) Central American Republic on an isthmus between Costa Rica and Colombia. It has an extensive coast line in the Atlantic and Pacific amounting to c. 450 m in the former and c. 800 m in the latter. The surface is mountainous, the highest point nearly 12,000 ft above sea level and there are many rivers, lakes and large stretches of forest. The climate is tropical and the republic was formerly extremely unhealthy but public health has improved since the building of the Panama Canal (q.v.). The population is mixed made up of whites, negroes and Indians with some Chinese and other Oriental races.

Panama was constituted a Republic in 1904 and is largely although more or less unofficially under U.S.A. control. It has no army or navy and the police are officered by Americans. By treaty Panama has U.S.A. protection in the event of war or civil war. The Canal Zone is not included in the Republic.

Bananas are the chief export all shipped to the U.S.A. Cacao and some coconuts, tortoise-shell, mother of pearl and pearls are also exported. Area 3,380 sq m pop 457,450.

Panama Canal connects the Atlantic and Pacific Oceans through the isthmus

of Panama Central America. It was first projected in the 16th cent and in 1879 a French company was formed under d'Leseps q.v. from 1890



G 1 Lock Pa on Ca 1 the Lanbbe
o dit

to 1880 work proceeded but the company went into liquidation. In 1894 a further company was organised but in 1902 rights were sold out to the U.S.A. Government. In the following year Panama broke away from Colombia and a republic was established which granted the U.S.A. a strip of land 10 m wide along the canal route. This zone is under military control. From 1906 work continued, improvements to sanitary conditions had to be undertaken first as yellow fever had caused thousands of deaths previously. The first ocean steamer passed through in Aug. 1914 but the canal was not opened officially until June 1915.

Numerous villages and towns have been built in the Canal Zone which is under the control of the U.S.A. Army. Colón, Panama, Balboa, Cristóbal and Darién are the principal ones. All the towns have a high standard of cleanliness, are well laid out and provided with hospitals, parks, restaurants and other amenities. Ship-repairing yards, bunker depots, radio stations and cold storage plants provide for all the needs of the ships passing through. A railway runs parallel to the canal. The canal itself is 50.7 statute m long with 6 locks. In 1931-2 over 4500 ships passed through. Area of Canal



Electric Mule, Panama Canal.

Zone, 553 sq m., pop 31,000 (8100 Americans)

Panama Canal Treaty: signed in Jan 1903 between the United States and Colombia, by which the United States acquired the canal rights and the port dues of the new Panama Company and subject to an annual subsidy and a lump sum of £2 millions obtained a strip of territory 10 m wide along the canal banks. See also HAI-PAUNCE-ROTT TREATY.

Pan-American Conferences, a series of conferences between representatives of the nations of America to discuss matters of common interest. Several conferences of Latin-American States were held in the 19th cent., notably the Pan-American Congress at Panama in 1826 and at Lima in 1861 before the United States issued invitations to the first Pan-American Conference at Washington in 1889. Recommendations were made for compulsory arbitration, a monetary union, and various matters of International Law which, however, were not ratified by the Government. This Conference set up a Bureau which developed into the Pan-American Union existing to promote co-operation between the nations of America. A second conference was held in Mexico City 1901-2 also at the suggestion of the United States. It extended arbitration discussions still farther, recommending as a practical measure adherence to the Hague Convention of 1899 (see Hague Conf.). and it took steps to ensure the convening of further conferences. The third conference, held in Rio de Janeiro, 1908 proposed modifications of international copyright law. The 4th Conference met at Buenos Aires in 1910 and recommended that the 5th Conference be convened at Santiago in 1913. This conference concerned itself with the question of how to set up a Pan-American Arbitral Court or American States, set up the Commission of Trade Relations between the member states. The 6th Conference met at Rio de Janeiro in 1924. It passed draft codes of International Law.

Pancakes, see BATTER.

Pancreas, a long glandular organ situated in the back of the abdomen behind the lower part of the stomach. Throughout its length of 6 to 8 ins. it is traversed by a duct which unites with the common bile duct from the liver to open into the duodenum, or first part of the small intestine, a few inches from the stomach. The general structure of the gland (see GLANDS) consists of tubes built up of columnar cells and bound together by connective tissue. The cells secrete material into each tube which unites with others to form a small duct. The small ducts join together to form the main pancreatic duct. The connective tissue is well supplied with nerves and blood vessels. The juice secreted by the pancreas flows into the small intestine as the food leaves the stomach. It is alkaline and contains trypsin, amylase or amylase, and steapsin, or lipase, which respectively break up proteins, starches, and fats, together with salts and a substance which curdles milk, and thus serves to aid digestion. A diseased pancreas causes impaired digestion and often diabetes, and is marked by general loss of health and sometimes swelling or tenderness in the right side of the upper abdomen. Fat people are liable to haemorrhage within the pancreas which may cause sudden death. The pancreas of sheep and calves is called sweetbread. See DIGESTIVE SYSTEM.

Panda (or Cat-Bear), a mammal of the order Carnivora belonging to a family related to that of the raccoon. About the size of a large cat, the panda, found in the E. Himalaya and the hills mainly on vegetables and fruit, is an arboreal species with a short coarse fur and a long ringed tail, hairy at the base. Hair beneath grey or black fur coloured reddish brown around the eyes, with the face mainly white. In the older regions of Tibet to the north the plant part is white, but only restricted to the true panda.

Pandora, in Greek mythology, the first woman, made by Hephaestus, &

gave her a sealed box for her betrothed Prometheus whom he wished to punish. Prometheus saw the god's intentions and would not marry Pandora but his brother Epimetheus did. When he opened Zeus's box evils, plagues and pests escaped into the world to harry man for ever. Last to emerge was Hope, the only antidote to the evils.

Pangalos Theodore (b. 1878) Greek general and politician in command of a regiment in Macedonia 1917 and Chief of Staff in Asia Minor 1919. In the revolution of 1922 he presided over the Commission enquiring into the conduct of the Asiatic campaign, the findings of which resulted in the execution of 6 ministers. In 1923 he became Premier by a coup d'état and dictator of the Hellenic Republic 1926. He was replaced by Kondyles (q.v.) later in the same year. He was imprisoned 1926-28 and since his release has taken little part in politics.

Pan Germanism, a movement for the furtherance of German imperialist aims. The systematic organisation of this movement began in 1891 and was heralded by the writings of German publicists dreaming of expansion; some hoped to see an Empire from the Adriatic to the Black Sea while others looked to the inclusion of Belgium, Holland and Luxembourg in Germany. In 1891 under the excitement aroused by the scramble for Africa a German League was formed. Reconstituted in 1894 as the Pan German League (*Alldeutsch Verband*) it aimed at the inculcation of greater patriotism, the promotion of a policy of expansion both in Europe and overseas and the union of Germans all over the world. The idea of a Central European Union under German influence was fostered by this League. Since the War the League has confined its activities to promoting a policy of German reconstruction. In Austria the movement has consistently worked for a union with Germany.

Pangolins (or Scaly Anteaters) are Mammals of the order Pholidota

formerly but wrongly associated with the true S. American anteaters of the order *Edentata* (q.v.). They are found in tropical Asia and Africa and are specially distinguished by their armour of overlapping scales formed of consolidated hairs. They have no teeth but the tongue is long, worm-like and sticky for gathering up the white ants whose mounds they tear to pieces with their strong claws. Most of the species



Pang 12

are climbers but the biggest about the size of a pig lives on the ground.

Panipat, town of British India memorable for 3 battles (1) April 1515 Babur the Mogul Emperor gained a complete victory over the Delhi Mohammedans under Ibrahim thus laying the foundation of the Mogul Empire (2) Nov 5 1526 Akbar the Great Mogul with 9000 men defeated the forces of the reviling Hindu Rajahs and re-erected Delhi (3) Jan 6 1761 the Afghans under Ahmed Shah Durani completely defeated the Mahrattas.

Panzica, Sir Anthony (1797-1870) librarian born in Italy. He was appointed Assistant Librarian at the British Museum in 1831, then Union Principal Librarian in 1847. He effected great improvements being responsible for the erection of the circular Reading Room.

Pankhurst, Emmeline (1858-1928) English suffragist and maiden married R. M. Pankhurst, an advocate for women's suffrage in 1879.

the Women's Franchise League in 1889. She attempted, at first by constitutional means, to persuade the Liberal Party to adopt her policy, but in 1892 she joined the Independent Labour Party. She afterwards founded the militant Women's Social and Political Union, and thenceforward was the leader of the law-breaking and hunger-striking of the *suffragettes*. She was imprisoned many times, notably for an attack on Lloyd George's house in 1913. In 1914 she ceased her suffragist activities and formed a women's emergency corps for national service. In 1919 women received votes and her campaign ceased. She was helped throughout her campaign by her daughters, Christabel (b. 1880) and Sylvia (b. 1882), the latter of whom was imprisoned (1920) for her revolutionary activities. *My Own Story*, by Mrs Pankhurst, was published in 1914.

Panmill, see CERAMICS

Pan-Slavism, a Slav nationalist movement, which arose in Austria and Hungary under the oppression of the Slavs by the dominant Magyars and Germans of the Dual Monarchy. The movement began as a literary and cultural revival, and was given added impetus by Magyar oppression during the Revolutions of 1848 (see HUNGARIAN WAR OF INDEPENDENCE), when the Emperor was able to play off the Slavs against the Magyars. Later Russia appeared in the role of protector of the Slavs, and in 1867 a Slav exhibition was held at St Petersburg. In 1870 Russia obtained the recognition of a Slav Church (part of the Eastern Orthodox Church) under the head of a Patriarch called the "Exarch" instead of the Greek Patriarch at Constantinople. The Pan-Slav movement encouraged the revolting Balkan States against the domination of Turkey (see EASTERN QUESTION). But with the growth of the powerful Slav State of Serbia in the Balkans the propaganda was directed against Austro-Hungarian rule of Slavs. Fuel was added to the flames by Austria's

annexation of Bosnia and Herzegovina in 1908.

Pansy (*Heartsease*), a small herbaceous wild plant (*Viola tricolor*) with oblong serrate leaves on an angled branched stem, deeply cut stipules, and flowers very variable in size and colour, which are, however, most often light yellow, either pure or tinged with purple. The cultivated varieties are numerous (see VIOLA).

Heartsease, or Wild Pansy

The pansy is found in cornfields and any cultivated land, and flowers all the summer.

Pantheism, the system of thought which maintains that the universe and God are identical, or that God is the only substance. It pervades a great deal of early Indian religious thought, especially in the Vedas (q.v.), and a pantheistic strain ran through much of Greek philosophy. The name itself is said to have been coined by John Toland in 1705. Among thinkers and philosophers of strongly pantheistic tendencies may be mentioned John Scotus Erirena (c. 875), Giordano Bruno (c. 1600), Spinosa (d. 1677), and Hegel (d. 1831).

God, according to pantheism, is imminent in all things, the "univeral soul," having no independent and transcendent existence apart from the world. Six schools of pantheism have been distinguished: (1) mechanical or materialistic pantheism, which sees God as the mechanical unity of existence; (2) ontological pantheism, that of Spinoza, which looks upon God as the single substance underlying all appearances; (3) dynamic pantheism; (4) psychical pantheism, or the representation of God

